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THE REGIS SCHOOL LOCAL AIR QUALITY ASSESSMENT

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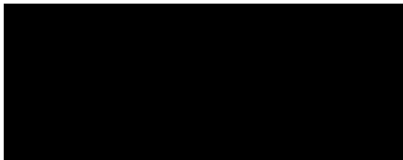
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1. INTRODUCTION

- 1.0.1. Ramboll has been commissioned by LJJ Ltd to undertake a local air quality assessment of The Regis School, Bognor Regis in order to identify any impacts that may be associated with a biomass boiler currently operational on the site. Complaints from occupants of the school have been received regarding odour and smoke presumed to originate from the stack under certain conditions. It has been inferred that start-up and shut-down of the biomass boiler ie operation at low loads are the most problematic. This assessment seeks to ascertain how emissions from the biomass boiler disperse.

1.1. Site Information

- 1.1.1. The Regis School is located off Westloats Lane, Bognor Regis, West Sussex. The site is centred at National Grid Reference 492229, 100019. The location of the site is shown in Figure 1.
- 1.1.2. The site is bounded by Firth Road to the southeast, Pevensey Road to the southwest, playing fields to the west and northwest and parking facilities and Southway Primary School to the north. The south of the site is bounded by residential properties along Firth Road and Pevensey Road.
- 1.1.3. A Binder RRK 640-850H biomass boiler which has a maximum output capacity of 600kW is located on site in an energy centre remote and to the east of the main school building. The boiler is fired using wood chip fuel. The biomass boiler is only used during school hours. However, as a worst case scenario within this assessment, the biomass boiler is assumed to run at 24 hours per day, seven days a week.

1.2. Scope of Assessment

- 1.2.1. The following issues have been considered within this report:
- i. Existing air quality at the site and surrounding locations;
 - ii. The presence and location of sensitive receptors, including locations along the school building façade; and
 - iii. Impacts on air quality within the site and surrounding locations as a result of emissions from the biomass boiler.

1.3. Potential Impacts

- 1.3.1. Emissions from the operation of the biomass boiler have the potential to adversely affect local pollution levels, both within and surrounding the school site. The main pollutants which occur as a result of the combustion of biomass are nitrogen dioxide (NO₂) and particulate matter (PM₁₀). At very high concentrations, NO₂ can irritate the airways of the lungs, increasing the symptoms of those suffering from respiratory diseases. PM₁₀ particles can be carried deep into the lungs, and at very high concentrations can cause inflammation and a worsening of heart and lung diseases. Standards set in regulations reflect the effect of these pollutants on human health.

1.4. Limitations

- 1.4.1. This report has been prepared for the benefit of LJJ Ltd and shall not be relied upon by any other party unless that party has been granted a contractual right to rely on this report for the purpose for which it has been prepared.

- 1.4.2. The findings and opinions in this report are based upon information derived from a variety of information sources. Ramboll believes these information sources to be reliable.
- 1.4.3. This report has been prepared on the basis of biomass boiler data provided by LJJ Ltd and Wood Energy Ltd.

2. RELEVANT POLICY AND LEGISLATION

2.1. Background

- 2.1.1. Local air quality is monitored and managed under a range of national and international legislation which sets out procedures, guidelines and standard limits for specific, commonly occurring, air pollutants. Legislation is based upon the effects of air pollutants to human health and safety, the environment, ecosystems, and effects to buildings and structures.

2.2. The European Air Quality Directives 2008/50/EC and 2004/107/EC

- 2.2.1. The European Air Quality Directive 2008/50/EC on ambient air quality and Cleaner Air For Europe (CAFE) establishes a strategic framework for setting European-wide limit and/or target values for seven pollutants (nitrogen oxides, particulate matter, sulphur dioxide, ozone, carbon monoxide, lead and benzene). Limit values for heavy metals and polycyclic aromatic hydrocarbons are established by the 4th Daughter Directive 2004/107/EC and are based on recommendations made by the World Health Organisation (WHO).
- 2.2.2. These directives have been transposed into legislation and implemented in England by the Air Quality Standards Regulations 2010¹. Overall responsibility for achieving the limits lies with the Secretary of State however local authorities have a role through their duties to work towards meeting the national air quality objectives (detailed in *Section 2.4*) which are similar, or in some cases more stringent than the EU limit values.

2.3. Air Quality Strategy for England, Scotland, Wales and Northern Ireland

- 2.3.1. The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS) most recently updated in July 2007². The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK.
- 2.3.2. The AQS covers ten air pollutants. These are ammonia (NH₃), benzene (C₆H₆), 1,3 butadiene (C₄H₆), carbon monoxide (CO), lead (Pb), oxides of nitrogen (NO_x) (including nitrogen dioxide NO₂), particulate matter (PM₁₀ and PM_{2.5}), sulphur dioxide (SO₂), ozone (O₃), and polycyclic aromatic hydrocarbons (PAHs).
- 2.3.3. The AQS sets standards and objectives for the ten listed pollutants. Standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects on human health (including sensitive sub-groups) or ecosystems. In general these are concentration limits above which sensitive members of the public (eg children, the elderly and the unwell) might experience adverse health effects. Objectives are policy targets often expressed as maximum concentrations not to be exceeded either without exception or with a limited number of exceedances within a specified timescale.
- 2.3.4. For some pollutants, there is both a long-term (eg annual mean) standard and a short-term (eg one hour mean) standard, to reflect the varying impacts on health of differing exposures to pollutants. Long-term standards are generally lower than short-term

1 The Air Quality Standards Regulations 2010, Statutory Instrument 2010 No. 1001

2 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland - Defra - July 2007

standards owing to the chronic health effects associated with exposure to low concentrations of pollutants for longer periods of time.

2.4. Air Quality (England) Regulations

2.4.1. Many of the objectives in the AQS were made statutory in England with the Air Quality (England) Regulations 2000³ and the Air Quality (England) (Amendment) Regulations 2002⁴ for the purpose of Local Air Quality Management (LAQM). The objectives for NO₂ and PM₁₀ which are relevant to this assessment are as follows:

- i. For NO₂
The long-term objective is an annual mean concentration of 40µg/m³ to be achieved by 31 December 2005; and the short-term objective is a one-hour mean concentration of 200µg/m³ not to be exceeded more than 18 times per year to be achieved by 31 December 2005.
- ii. For PM₁₀
The long-term objective is an annual mean concentration of 40µg/m³ to be achieved by 31 December 2004; and the short-term objective is a 24-hour mean concentration of 50µg/m³ not to be exceeded more than 35 times per year to be achieved by 31 December 2004.

2.4.2. Objectives included in the Air Quality (England) Regulations are generally more stringent than those included within EU legislation and other English regulations. Throughout this report, reference to statutory standards or objectives means those included within the Air Quality (England) Regulations.

2.4.3. The objectives apply at locations where members of the public would be exposed over the relevant exposure period. For example, the annual mean objective applies at the building facades of residential properties and public buildings, but does not apply in gardens of residential properties, at the building facades of offices or other places of work or at kerbside locations where public exposure would be short-term. The one hour mean objective would apply at any outdoor location where members of the public might reasonably be expected to spend an hour or longer.

2.5. Local Air Quality Management (LAQM)

2.5.1. Part IV of the Environment Act 1995 requires local authorities to periodically review and assess the quality of air within their administrative area. The reviews have to consider the present and future air quality and whether any air quality objectives prescribed in regulations are being achieved or are likely to be achieved in the future.

2.5.2. Where any of the prescribed air quality objectives are not likely to be achieved the authority concerned must designate an Air Quality Management Area (AQMA).

2.5.3. For each AQMA the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality objectives. Local authorities are not statutorily obliged to meet the objectives, but they must show that they are working towards them.

3 The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No 928

4 The Air Quality (England) (Amendment) Regulations 2002 - Statutory Instrument 2002 No 3043

- 2.5.4. DEFRA has published technical guidance for use by local authorities in their review and assessment work⁵. This guidance, referred to in this report as LAQM.TG(09), has been reviewed and used, where appropriate, within the assessment.

2.6. Local Air Quality Management in Arun District Council

- 2.6.1. Arun District Council undertakes annual updates and screening assessments of local air quality in order to assess whether objectives are being met. The latest screening assessment⁶ shows that there are currently no AQMAs located within the boundary of Arun District council and that air quality meets the relevant air quality standards.

2.7. Planning Policy and Guidance

The National Planning Policy Framework (NPPF)

- 2.7.1. The NPPF⁷ sets out the Government's planning policies for England and how these are expected to be applied. This replaces previous pollution control guidance contained within Planning Policy Statement (PPS) 23.
- 2.7.2. The NPPF advises that the planning system should prevent both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of air pollution.

Local Development Framework

- 2.7.3. The Localism Act adopted in November 2011 introduced profound changes to the current planning policy and guidance, including revoking Regional Spatial Strategies and changing the structure of Local Development Frameworks (LDFs). Arun District Council is yet to publish version of its LDF which would comply with the new legislation. However, there is currently a new Local Plan⁸ being drafted.
- 2.7.4. Policy DM27 from the draft Local Plan specifically relates to air pollution. Arun District Council recognises that clean air is critical to health and wellbeing and has also identified areas of concern where air quality is poorest within the council. These areas are located adjacent to main roads: the A27, A29 and A259 (approximately 500m north east of the site).

5 DEFRA: Part IV The Environment Act 1995 Local Air Quality Management Technical Guidance LAQM.TG(09) (February 2009)

6 2012 Air Quality Updating and Screening Assessment for Arun District Council, April 2012

7 National Planning Policy Framework Department for Communities and Local Government (March 2012)

8 Local Plan Consultation Doc 19.07012 Arun District Council. Available at:

http://www.arun.gov.uk/mediafiles/downloads/43599272/20120709_Accessible_Local_Plan_for_Web.pdf
[Accessed: 19 October 2012]

3. METHODOLOGY

3.1. Scope of the Assessment

- 3.1.1. The scope of the assessment has been determined by the following:
- A review of the local air quality data surrounding the site including data from Arun District Council and Defra's UK-AIR website⁹;
 - Desk study to confirm the locations of any sensitive receptors that may be affected by the running of the biomass boiler. This includes an receptors on the school site; and
 - A review of emissions data for the biomass boiler.
- 3.1.2. The assessment of existing baseline conditions has been undertaken utilising the following sources of information:
- Local authority websites and local air quality reports;
 - Defra's UK-AIR website; and
 - Environment Agency website¹⁰.

3.2. Biomass Boiler Modelling

- 3.2.1. Air quality impacts of the biomass boiler have been assessed using the Breeze AERMOD air quality dispersion model and following guidance published by DEFRA. Breeze AERMOD uses representative meteorological data for the local area and plant emissions data to predict ambient concentrations of pollutants in the vicinity of the stack. More details on Breeze AERMOD are presented in Appendix A.

Parameters and Emissions used within the Dispersion Model

- 3.2.2. Biomass boiler parameters and emission rates used in the model were sourced from the LJJ Ltd and Wood Energy Ltd and are presented below in
- 3.2.3. Table 1. Table 2 presents low load operating conditions which have been inferred from full load data. In this assessment a stack height of 7m has been used to reflect the terminus of the as built stack.
- 3.2.4. Emissions during start up and shut down of the unit will be transient and may be higher than those assumed within the modelling assessment. However, the transient and short-term nature during these times means that they will not have a significant impact on the predicted concentrations presented later in this report. A discussion of these emissions is given in section 5.

Table 1 Full Load Biomass Boiler Emission Parameters Used in the Assessment

Parameter	Value
Internal Stack Diameter	45cm
Height of Stack	7m AGL

⁹ <http://uk-air.defra.gov.uk> sourced October 2012

¹⁰ www.environment-agency.gov.uk sourced October 2012

Parameter	Value
Emission Temperature	180oC
Emission Velocity	3.8m/s
NOx Emission Rate	0.076 g/s
PM10 Emission Rate	0.02 g/s

Table 2 Low Load Biomass Boiler Emission Parameters used in the Assessment

Parameter	Value
Internal Stack Diameter	45cm
Height of Stack	7m AGL
Emission Temperature	134oC
Emission Velocity	0.76m/s
NOx Emission Rate	0.015 g/s
PM10 Emission Rate	0.0025 g/s

- 3.2.5. The emission rates shown in Tables 1 and 2 assume that the biomass boiler will be operating at full load 24 hours a day every day of the year.
- 3.2.6. The emissions assumed in the assessment represent a very worst case of annual emissions as no account has been taken of the facilities operating hours.

Conversion of NOx to NO₂

- 3.2.7. The biomass boiler emission rates used within the model are provided as NO_x rather than NO₂. NO_x includes seven oxides of nitrogen, but is commonly used to describe concentrations of nitric acid (NO) and NO₂, which are the oxides of nitrogen most commonly found in significant concentrations. At the point of emission from the biomass boiler stack the majority of NO_x will be in the form NO. NO is a relatively harmless gas, and air quality objectives have not been set for this compound. After release into the atmosphere, NO will be converted to NO₂ via a complex series of photochemical reactions with other gases present in the ambient air, including ozone.
- 3.2.8. For the purpose of this assessment a 100% conversion rate of NO_x to NO₂ has been assumed. When detailed modelling is undertaken operators are advised¹¹ to use a conversion rate of 35% for short-term concentrations and 70% for long term concentrations, with operators asked to provide justification if lower percentages are used. Consequently, the 100% conversion rate assumed in this assessment represents a worst case scenario.

3.3. Inclusion of Building Effects

- 3.3.1. The effects of buildings close to the biomass boiler stack on pollutant dispersion were included in the model. Buildings included within the assessment which may affect plume dispersion are shown below in Table 3.

¹¹ Environment Agency Datasheet. Air Quality Modeling and Assessment Unit, Environment Agency, 29 Newport Road, Cardiff CF24 0TB

Table 3 Buildings Considered within the Assessment

Buildings	Height (m)
School Building	18.1
Energy Centre	5

3.4. Meteorological Data

- 3.4.1. Meteorological (met) data, such as wind speed and direction, are used by the model to determine pollutant transportation and dilution. Met data used in this assessment was collected at the Met Office observing station at Thorney Island. Data was obtained from 2007 to 2011.
- 3.4.2. An initial assessment of NO_x emissions from the biomass boiler was undertaken comparing the effect of recent met years on the modelled results. Modelled NO_x concentrations were highest using met data from 2010. The results presented within Section 5 were therefore modelled using 2010 met data to represent a worst case scenario.
- 3.4.3. Thorney Island met station is considered to provide data representative of the conditions at the Development Site. The wind rose for 2010 met data used within the assessment is shown below in Figure 2. The prevailing wind direction at the Development Site is south-westerly.

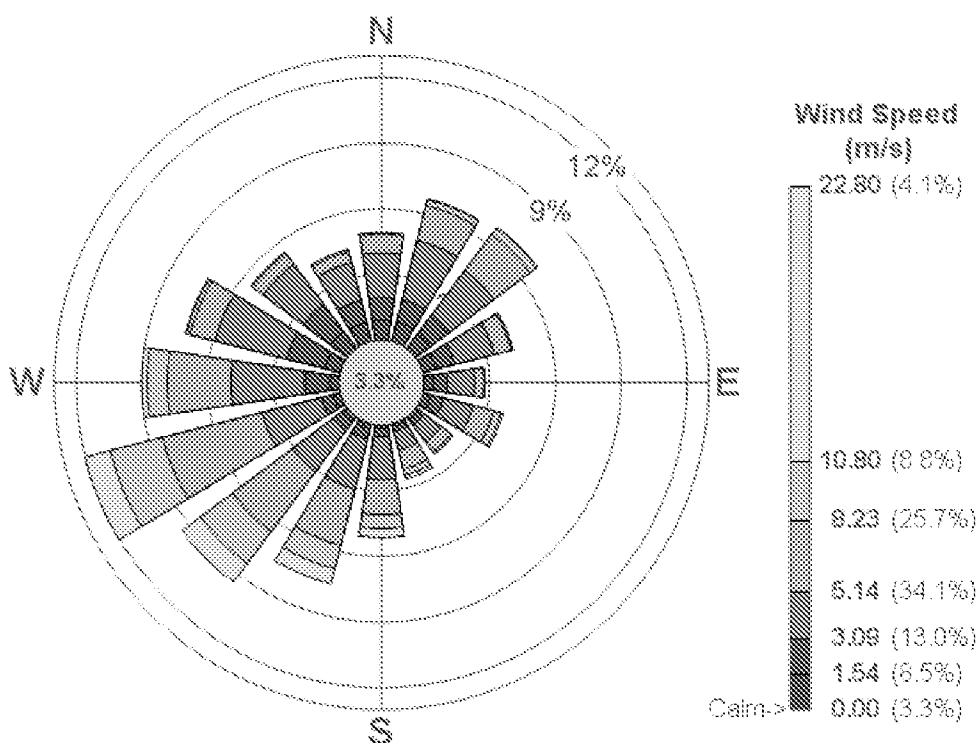


Figure 2: Meteorological Wind Rose from Thorney Island, 2010

Sensitive Receptors

- 3.4.4. Impacts from the biomass boiler on site have been modelled using the Breeze Aermod air quality dispersion model.
- 3.4.5. Table 4 shows the names and locations of discrete receptors used within the model. The discrete receptors were selected to represent places where members of the public may receive exposure to pollutants from the biomass boiler, for example within the school building (given the complaint from an occupant of the school) and residential properties close to the school building. Fourteen discrete receptors locations have been modelled each at varying heights. The locations of the discrete receptors are shown on Figure 4.

Table 4 Discrete Receptors Used in the Model

Location	Grid Reference		Height (m)
	X	Y	
Window 1 SE	492248	99991	2.3, 6.35, 10.02, 13.7
Window 2 SE	492247	99982	2.3, 6.35, 10.02, 13.7
Window 3 SE	492249	99972	2.3, 6.35, 10.02, 13.7
Window 4 SE	492251	99963	2.3, 6.35, 10.02, 13.7
Window 5 SE	492253	99957	2.3, 6.35, 10.02, 13.7
Window 1 E (Directly above EC)	492250	100002	6.35, 10.02, 13.7
Window 2 E (Directly above EC)	492250	100009	6.35, 10.02, 13.7
Corner East Building			2.3, 6.35, 10.02, 13.7
Main Entrance 1	492252	100034	2.3, 6.35, 10.02, 13.7
Main Entrance 2	492254	100027	2.3, 6.35, 10.02, 13.7
Window 1 W	492218	100004	2.3, 6.35, 10.02, 13.7
Window 2 W	492224	99983	2.3, 6.35, 10.02, 13.7
Window 3 West	492233	99959	2.3, 6.35, 10.02, 13.7
30 Frith Road	492365	100014	0, 2.5

3.5. Model Validation and Verification

- 3.5.1. The Breeze Aermod dispersion models have been widely validated for this type of assessment and are considered to be fit for purpose. The models are also listed in Government guidance document LAQM.TG3(00) – Review and Assessment: Selection and Use of Dispersion Models.

3.6. Significance Assessment

- 3.6.1. A quantitative assessment of the effects on local air quality from the biomass boiler emissions has been completed against the current statutory standards and objectives for NO₂ as set out in Section 2.5.

- 3.6.2. There are no official guidelines for quantifying the degrees of significance associated with changes in local air quality arising from developments.
- 3.6.3. The Institute of Air Quality Management (IAQM) gives general guidance¹² relating to determining the significance of air quality impacts due to a development. In order to create an overall significance descriptor for a development it recommends that it should be based on professional judgement, and should take into account the following factors relevant to the assessment:
- The magnitudes of the changes and the descriptions of the impacts at the receptors ie Table 5 and Table 6 affected by increases and/or decreases in concentrations and a judgement on the overall balance;
 - Where new exposure is being introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant;
 - Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased.
 - Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced;
 - Uncertainty, including the extent to which worst-case assumptions have been made; and
 - The extent to which an objective or limit value is exceeded, eg an annual mean NO₂ of 41µg/m³ should attract less significance than an annual mean of 51µg/m³.
- 3.6.4. The criteria set out in Table 5 and Table 6, are based on those set out by Environmental Protection UK¹³ and the IAQM, and relate to concentrations of NO₂ and PM₁₀. These have been applied where necessary to allow a degree of quantification of the magnitude of change and of impacts. Although Table 5 describes the potential impacts as a result of a proposed development, these magnitude descriptors can be used in order to determine the change in concentrations that are currently occurring as a result of the operational biomass boiler on site at the moment.

Table 5 Definition of Magnitude for Changes in Ambient Pollutant Concentrations as Percentage of the Objective Level

Magnitude of Change	Percent Range
Large	Increase/decrease >10%
Medium	Increase/decrease 5 - 10%
Small	Increase/decrease 1 - 5%
Imperceptible	Increase/decrease <1%

12 Position on the Description of Air Quality Impacts and the Assessment of their Significance, Institute of Air Quality Management, November 2009

13 Development Control: Planning For Air Quality (2010 Update), Environmental Protection UK, April 2010

Table 6 Air Quality Impact Magnitude Descriptors for Changes to NO₂ and PM₁₀ Concentrations at a Receptor

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with scheme			
Above Objective/Limit Value with Scheme	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with Scheme	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with Scheme	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with Scheme	Negligible	Negligible	Slight Adverse
Decrease with scheme			
Above Objective/Limit Value without Scheme	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value without Scheme	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value without Scheme	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value without Scheme	Negligible	Negligible	Slight Beneficial

4. BASELINE

4.0.1. The site is located approximately 1.6km from the urban centre of Bognor Regis. It is in a semi-rural location but is located within close proximity to residential developments. Chichester Road (A259), identified as being subject to elevated pollutant concentrations in the draft Local Plan is located approximately 520m to the northeast of the site.

4.0.2. There are no industrial sources of pollution within 1km of the site.

4.1. Modelled Background Data

4.1.1. Defra's UK-AIR includes computer modelled predictions of background concentrations of air pollutants over the UK. Background concentrations are those levels that would be observed away from specific sources such as roads and industry.

4.1.2. Background data from Defra's UK-AIR has been sourced from National Grid Squares 491500, 100500, 491500, 99500, 492500, 100500 and 492500, 99500. The site is located in the centre of these grid squares. An average has been taken of the data collected from these four locations in order to give a representative view of the site. The results shown in

4.1.3. Table 7 shows that no exceedences of NO₂ or PM₁₀ have been modelled at background locations in the period 2010 to 2012 or are expected between 2012 and 2015.

Table 7 UK-AIR Annual Mean Background Concentrations (µg/m³)

Pollutant	Year					
	2010	2011	2012	2013	2014	2015
NO ₂	13.89	13.46	13.04	12.61	12.19	11.76
NO _x	18.67	18.02	17.38	16.74	16.09	15.45
PM ₁₀	14.33	14.17	14.00	13.85	13.69	13.52

Council Measurement Data

4.2. Automatic Monitoring

4.2.1. Arun District Council have no automatic monitoring stations. However, they are part of the Sussex Air Quality Partnership (Sussex-Air) which monitors air quality across the whole of Sussex. A mobile monitoring unit run by Sussex-Air unit was located approximately 1.6km north-west of the development; however no data is available from this unit.

4.2.2. Arun District Council has no PM₁₀ monitoring sites within its boundaries.

4.3. Non-Automatic Monitoring

4.3.1. Arun District Council operates 17 NO₂ diffusion tube sites across the area. Six of these are located in Bognor, the closest of which is located approximately 1.25km to the north-east of the site located on Church Lane. Table 8 shows the diffusion tube data for Bognor between 2008 and 2011.

Table 8 Council Measurement Data for NO₂ – Diffusion Tube Sites

Location	Site Type	Position Relative to Site	Monitored NO ₂ Concentration (µg/m ³)			
			2008	2009	2010	2011
BR High Street	Urban Roadside	1.78km SE	30	27	32	26
Church Lane	Urban Background	1.25km NE	18	18	20	15
Mornington Crescent	Urban Background	3.1km W	16	18	19	15
Canada Grove	Urban Roadside	1.30km SE	30	24	26	20
A259 Felpham Way	Urban Roadside	3.5km W	36	37	38	29
A259 Flansham Lane	Urban Roadside	4km W	36	37	38	29

- 4.3.2. The results shown in Table 8 above show that no exceedences of the NO₂ objective occurred at any of the diffusion tube sites in Bognor between 2008 and 2011. The sites located along the A259 were close to exceeding the objective between 2008 and 2010; however, concentrations were significantly reduced in 2011. Arun District Council do not expect the relevant air quality objectives to be exceeded in 2012¹⁴.

4.4. Summary of Baseline Data

- 4.4.1. Council measurement data for NO₂ show that there have been no exceedences of the NO₂ objective of 40µg/m³ at any of the monitoring locations. Background data from UK-AIR also show that no exceedences occurred between 2010 and 2012 and also that none are predicted between 2012 and 2015.
- 4.4.2. Arun District Council do not operate any PM₁₀ monitoring sites within the district, however, data shown in Table 8 from UK-AIR demonstrates that no exceedences of the PM₁₀ objective of 40µg/m³ occurred between 2010 and 2012 and none are predicted to occur between 2012 and 2015 at background locations.

14 2012 Air Quality Updating and Screening Assessment for Arun District Council (April 2012).

5. EFFECTS APPRAISAL

- 5.1.1. 5.0.1. Results obtained from dispersion modelling have been combined with representative background concentrations for the area, allowing direct comparisons with the air quality standards to be drawn at each of the chosen receptors. Council diffusion tube data from Church Lane was used for the relevant background concentrations for NO₂ and Defra modelled background data was used for PM₁₀. In both cases, data from 2011 were used. The results shown in

Table 9 to Table 16 are the highest predicted concentrations (across all heights modelled) at each modelled receptor locations (0 to 14). A full list of results including modelled concentrations for all heights is presented in Appendix B.

- 5.0.2. The results represent a worst case assessment of the impact of the biomass boiler due to the assumptions made regarding the operating conditions. These include the boiler running 24 hours a day, seven days a week and the use of a 100% conversion rate of NO_x to NO₂.
- 5.0.3. In addition to the normal running conditions, low load conditions were also modelled in order to assess if this impacted the dispersion of emissions from the biomass boiler. The parameters used for the low load scenario can be found in Table 2.

5.2. Modelled Annual NO₂ Concentrations

Full Load

Table 9 Highest Modelled Annual Mean NO₂ Concentrations Resulting from the Biomass Boiler on Site (Full Load)

Location Number	Location Name	Height (m)	Without Biomass Boiler Concentration (µg/m ³)	Impact of Biomass Boiler (µg/m ³)	Total Background and Biomass Boiler Concentration (µg/m ³)	Increase as % of Objective (%)	Significance of Change	Impact Descriptor
0	Grid Max	0	15	4.32	19.32	10.80	Large	Slight Adverse
1	Window 1 SE	2.30	15	4.13	19.13	10.33	Large	Slight Adverse
2	Window 2 SE	2.30	15	3.86	18.86	9.66	Medium	Negligible
3	Window 3 SE	2.30	15	3.24	18.24	8.09	Medium	Negligible
4	Window 4 SE	2.30	15	2.60	17.60	6.50	Medium	Negligible
5	Window 5 SE	2.30	15	2.39	17.39	5.96	Medium	Negligible
6	Window 1 E (Directly above EC)	6.35	15	3.45	18.45	8.63	Medium	Negligible
7	Window 2 E (Directly above EC)	6.35	15	3.29	18.29	8.22	Medium	Negligible
8	Corner East Building	2.30	15	3.43	18.43	8.57	Medium	Negligible

Location Number	Location Name	Height (m)	Without Biomass Boiler Concentration ($\mu\text{g}/\text{m}^3$)	Impact of Biomass Boiler ($\mu\text{g}/\text{m}^3$)	Total Background and Biomass Boiler Concentration ($\mu\text{g}/\text{m}^3$)	Increment on % of Objective (%)	Magnitude of Change	Impact Description
9	Main Entrance 1	2.30	15	2.90	17.90	7.25	Medium	Negligible
10	Main Entrance 2	2.30	15	2.41	17.41	6.02	Medium	Negligible
11	Window 1 W	2.30	15	3.42	18.42	8.56	Medium	Negligible
12	Window 2 W	2.30	15	4.09	19.09	10.22	Large	Slight Adverse
13	Window 3 West	2.30	15	3.40	18.40	8.50	Medium	Negligible
14	30 Frith Road	0.00	15	1.60	16.60	4.01	Small	Negligible

- 5.2.1. The objective for annual NO_2 concentrations is $40\mu\text{g}/\text{m}^3$ to be achieved by the end of 2005.
- 5.2.2. Assuming 100% conversion of NO_x to NO_2 , increases in concentrations attributable to the biomass boiler of a large magnitude would be expected at the grid max (maximum modelled concentration within the 1km^2 grid). When considering the local air quality in this location (based on a worst case scenario presented above), this would represent a slight adverse impact on local air quality due to low existing background concentrations.
- 5.2.3. The grid max is located approximately 17m to the west of the stack, in the immediate vicinity of the school building. This is close to the receptor Window 1 E (Directly Above EC). The total background and boiler concentration at the grid max location remains well within the annual air quality objective of $40\mu\text{g}/\text{m}^3$.
- 5.2.4. The highest concentrations at a discrete receptor occurred at 'Window 1 SE' and 'Window 2 W' both at the ground floor (2.3m) the location of which are shown on Figure 4. The maximum concentrations that are attributable to the biomass boiler modelled in these locations are $4.13\mu\text{g}/\text{m}^3$ and $4.09\mu\text{g}/\text{m}^3$ respectively. These represent a large magnitude of change. However, due to the low existing background concentrations, the impact is considered to be Slight Adverse.
- 5.2.5. A residential property was also modelled in order to assess impacts on nearby off-site sensitive receptors. The modelled results demonstrate a small magnitude of change, and a corresponding negligible impact based on EPUK guidance.
- 5.2.6. Modelled concentrations at the remaining discrete receptors ranged between $3.86\mu\text{g}/\text{m}^3$ (Window 2 SE, 2.3m) to $0.96\mu\text{g}/\text{m}^3$ (Window 5 SE, 13.7m) and correspond to a medium or small magnitude of change and an associated negligible impact.

Low Load

Table 10 Highest Modelled Annual Mean NO₂ Concentrations Resulting from the Biomass Boiler on Site (Low Load)

Receptor Number	Location Name	Height (m)	Height of Biomass Boiler (m)	Annual Concentration without Biomass Boiler (µg/m ³)	Annual Background and Biomass Boiler Concentration (µg/m ³)	Annual Air Quality Objective (µg/m ³)	Magnitude of Change	Impact Description
0	Grid Max	0	15	1.32	16.32	3.30	Small	Negligible
1	Window 1 SE	2.3	15	1.29	16.29	3.22	Small	Negligible
2	Window 2 SE	2.3	15	1.18	16.18	2.95	Small	Negligible
3	Window 3 SE	2.3	15	0.98	15.98	2.46	Small	Negligible
4	Window 4 SE	2.3	15	0.79	15.79	1.98	Small	Negligible
5	Window 5 SE	2.3	15	0.78	15.78	1.95	Small	Negligible
6	Window 1 E (Directly above EC)	6.35	15	1.11	16.11	2.76	Small	Negligible
7	Window 2 E (Directly above EC)	6.35	15	1.05	16.05	2.63	Small	Negligible
8	Corner East Building	2.3	15	1.09	16.09	2.72	Small	Negligible
9	Main Entrance 1	2.3	15	0.93	15.93	2.33	Small	Negligible
10	Main Entrance 2	2.3	15	0.75	15.75	1.87	Small	Negligible
11	Window 1 W	2.3	15	0.97	15.97	2.42	Small	Negligible
12	Window 2 W	2.3	15	1.12	16.12	2.80	Small	Negligible
13	Window 3 West	2.3	15	0.92	15.92	2.30	Small	Negligible
14	30 Frith Road	0	15	0.63	15.63	1.57	Small	Negligible

- 5.2.7. Based on the low load operation presented above, increases in concentrations attributable to the biomass boiler of a small magnitude would be expected at the grid max (maximum modelled concentration within the 1km² grid). This presents a negligible impact on local air quality due to low existing background concentrations.
- 5.2.8. The grid max is located approximately 17m to the west of the stack, in the immediate vicinity of the school building. This is close to the receptor Window 1 E (Directly above EC). The total background and boiler concentration at the grid max location remains well within the annual air quality objective of 40µg/m³.
- 5.2.9. The highest concentration at a discrete receptor occurred at 'Window 1 SE' at the ground floor (2.3m) the location of which is shown on Figure 4. The maximum concentration that is attributable to the biomass boiler modelled in this location is 1.29µg/m³ which represents a small magnitude of change. Consequently, the impact is considered to be negligible.

- 5.2.10. The modelled results at the residential property (30 Frith Road) demonstrated a change in concentration of a small magnitude, and a corresponding negligible impact based on EPUK guidance.
- 5.2.11. Modelled concentrations at the remaining discrete receptors ranged between $0.34\mu\text{g}/\text{m}^3$ (Window 5 SE, 13.7m) to $1.18\mu\text{g}/\text{m}^3$ (Window 2 SE, 2.3m) and correspond to an imperceptible or small magnitude of change and an associated negligible impact.

5.3. Modelled Hourly Mean NO_2 Concentrations

Full Load

Table 11 Maximum Modelled Hourly and 99.8th Percentile Hourly NO_2 Concentrations Resulting from the Biomass Boiler on Site (Full Load)

Location Number	Location Name	Height (m)	Assumed Background Concentration ($\mu\text{g}/\text{m}^3$)	Model Predicted Concentration ($\mu\text{g}/\text{m}^3$)	Total Background and Model Predicted Concentration ($\mu\text{g}/\text{m}^3$)	Maximum 1 hour Concentration Resulting from Biomass Boiler ($\mu\text{g}/\text{m}^3$)
0	Grid Max		30	55.12	85.12	80.22
1	Window 1 SE	2.30	30	22.56	52.56	30.24
2	Window 2 SE	2.30	30	23.51	53.51	31.52
3	Window 3 SE	2.30	30	22.70	52.70	28.53
4	Window 4 SE	2.30	30	21.83	51.83	25.87
5	Window 5 SE	13.70	30	28.50	58.50	36.25
6	Window 1 E (Directly above EC)	6.35	30	17.95	47.95	23.99
7	Window 2 E (Directly above EC)	6.35	30	16.46	46.46	26.45
8	Corner East Building	2.30	30	17.33	47.33	34.19
9	Main Entrance 1	2.30	30	15.63	45.63	39.08
10	Main Entrance 2	2.30	30	13.65	43.65	38.78
11	Window 1 W	2.30	30	20.21	50.21	28.26
12	Window 2 W	2.30	30	28.50	58.50	42.68
13	Window 3 West	2.30	30	32.53	62.53	42.59
14	30 Frith Road	0.00	30	28.45	58.45	53.59

- 5.3.1. The air quality objective for short-term NO_2 concentrations is $200\mu\text{g}/\text{m}^3$, not to be exceeded more than 18 times per year. Using an assumed background concentration of twice the annual mean NO_2 background concentration, no exceedences are predicted within

the 1km² receptor grid. The maximum increment in hourly concentrations was 80.22µg/m³. The highest increment on the 99.8th percentile was 55.12µg/m³ at the grid max location.

- 5.3.2. The predicted hourly mean NO₂ concentrations with the biomass boiler operating at full load are well below the objective.

Low Load

Table 12 Maximum Hourly and 99.8th Percentile Hourly NO₂ Concentrations Resulting from the Biomass Boiler on Site (Low Load)

Location Number	Location	Height (m)	Assumed Background Concentration (µg/m ³)	99.8 th Percentile Concentration (1 Hour) (µg/m ³)	Total Background and 99.8 th Percentile Concentration (µg/m ³)	Maximum 1 Hour Concentration Resulting from Biomass Boiler (µg/m ³)
0	Grid Max	0	30	15.44	45.44	27.68
1	Window 1 SE	2.3	30	8.84	38.84	10.89
2	Window 2 SE	2.3	30	8.65	38.65	10.93
3	Window 3 SE	2.3	30	8.85	38.85	11.51
4	Window 4 SE	2.3	30	7.97	37.97	11.89
5	Window 5 SE	2.3	30	10.15	40.15	15.15
6	Window 1 E (Directly above EC)	6.35	30	7.17	37.17	9.97
7	Window 2 E (Directly above EC)	6.35	30	6.62	36.62	10.99
8	Corner East Building	2.3	30	6.81	36.81	14.20
9	Main Entrance 1	2.3	30	6.63	36.63	16.23
10	Main Entrance 2	2.3	30	5.72	35.72	16.11
11	Window 1 W	2.3	30	6.14	36.14	8.43
12	Window 2 W	2.3	30	9.33	39.33	13.92
13	Window 3 West	2.3	30	9.56	39.56	15.34
14	30 Frith Road	0	30	12.28	42.28	23.42

- 5.3.3. Using an assumed background concentration of twice the annual mean NO₂ background concentration, no exceedences are predicted within the 1km² receptor grid. The maximum increment in hourly mean concentrations was 27.68µg/m³. The highest increment on the 99.8th percentile was 15.44µg/m³ at the grid max location. This is well within the objective limit.
- 5.3.4. The predicted hourly mean NO₂ concentrations with the biomass boiler operating at low load remain well below the objective.

5.4. Modelled Annual PM₁₀ Concentrations

Full Load

Table 13 Highest Annual Mean PM₁₀ Concentrations Resulting from the Biomass Boiler on Site (Full Load)

Receptor Number	Location	Height (m)	Background PM ₁₀ Concentration (µg/m ³)	Impact of Proposed Boiler (µg/m ³)	Total Background and Proposed Boiler Concentration (µg/m ³)	Annual Mean PM ₁₀ Concentration (µg/m ³)	Magnitude of Change	Impact Description
0	Grid Max	0	14.17	1.14	15.31	2.85	Small	Negligible
1	Window 1 SE	2.3	14.17	1.09	15.26	2.72	Small	Negligible
2	Window 2 SE	2.3	14.17	1.02	15.19	2.54	Small	Negligible
3	Window 3 SE	2.3	14.17	0.85	15.02	2.13	Small	Negligible
4	Window 4 SE	2.3	14.17	0.68	14.85	1.71	Small	Negligible
5	Window 5 SE	2.3	14.17	0.63	14.80	1.57	Small	Negligible
6	Window 1 E (Directly above EC)	6.35	14.17	0.91	15.08	2.27	Small	Negligible
7	Window 2 E (Directly above EC)	6.35	14.17	0.86	15.03	2.16	Small	Negligible
8	Corner East Building	2.3	14.17	0.90	15.07	2.26	Small	Negligible
9	Main Entrance 1	2.3	14.17	0.76	14.93	1.91	Small	Negligible
10	Main Entrance 2	2.3	14.17	0.63	14.80	1.58	Small	Negligible
11	Window 1 W	2.3	14.17	0.90	15.07	2.25	Small	Negligible
12	Window 2 W	2.3	14.17	1.08	15.25	2.69	Small	Negligible
13	Window 3 West	2.3	14.17	0.89	15.06	2.24	Small	Negligible
14	30 Frith Road	0	14.17	0.42	14.59	1.05	Small	Negligible

- 5.4.1. The air quality objective for annual mean PM₁₀ concentrations is 40µg/m³ to be achieved by the end of 2004.
- 5.4.2. Modelled results identified above in Table 13 shows that the maximum annual PM₁₀ concentration was 1.14µg/m³ at the grid max, located approximately 17m west of the biomass boiler stack in the immediate vicinity of the school building. The potential magnitude of change in concentration as a result of the biomass boiler is expected to be small. This would result in a negligible impact on local air quality if the plant is running at full load based on EPUK guidance.
- 5.4.3. The maximum concentration at a discrete receptor was found to be at 'Window 1 SE' at a height of 2.3m. The modelled results show a concentration of 1.09µg/m³ is to be expected

as a result of the biomass boiler. This represents a change in concentration of a small magnitude and a corresponding negligible impact on local air quality. Despite any increases in PM₁₀ concentrations, the modelled results show that concentrations are well below the air quality objective.

Low Load

Table 14 Highest Annual Mean PM₁₀ Concentrations Resulting from the Biomass Boiler on Site (Low Load)

Location Number	Location	Height (m)	Modelled Biomass Boiler Concentration (µg/m ³)	Impact of Biomass Boiler (µg/m ³)	Total Background and Biomass Boiler Concentration (µg/m ³)	Increase on Total Objective (%)	Magnitude of Change	Impact Description
0	Grid Max	0	14.17	0.22	14.39	0.55	Imperceptible	Negligible
1	Window 1 SE	2.3	14.17	0.21	14.38	0.54	Imperceptible	Negligible
2	Window 2 SE	2.3	14.17	0.20	14.37	0.49	Imperceptible	Negligible
3	Window 3 SE	2.3	14.17	0.16	14.33	0.41	Imperceptible	Negligible
4	Window 4 SE	2.3	14.17	0.13	14.30	0.33	Imperceptible	Negligible
5	Window 5 SE	2.3	14.17	0.13	14.30	0.32	Imperceptible	Negligible
6	Window 1 E (Directly above EC)	6.35	14.17	0.18	14.35	0.46	Imperceptible	Negligible
7	Window 2 E (Directly above EC)	6.35	14.17	0.18	14.35	0.44	Imperceptible	Negligible
8	Corner East Building	2.3	14.17	0.18	14.35	0.45	Imperceptible	Negligible
9	Main Entrance 1	2.3	14.17	0.16	14.33	0.39	Imperceptible	Negligible
10	Main Entrance 2	2.3	14.17	0.12	14.29	0.31	Imperceptible	Negligible
11	Window 1 W	2.3	14.17	0.16	14.33	0.40	Imperceptible	Negligible
12	Window 2 W	2.3	14.17	0.19	14.36	0.47	Imperceptible	Negligible
13	Window 3 West	2.3	14.17	0.15	14.32	0.38	Imperceptible	Negligible
14	30 Frith Road	0	14.17	0.11	14.28	0.26	Imperceptible	Negligible

- 5.4.4. Table 14 shows the modelled annual PM₁₀ concentrations for the biomass boiler running at low load. The grid max concentration was 0.22µg/m³ and the maximum concentration at a discrete receptor was 0.21µg/m³. This was at 'Window 1 SE' at a height of 2.3m.

- 5.4.5. Modelled results shown in Table 14 indicate that when the biomass boiler is running at low load, magnitudes of change in PM₁₀ concentrations are expected to be imperceptible with the resultant impact on local air quality being negligible at all receptors.

5.5. Modelled 24 hour PM₁₀ Concentrations

Full Load

Table 15 Maximum Hourly and 90.4th Percentile 24 Hour PM₁₀ Concentrations Resulting from the Biomass Boiler on Site (Full Load)

Location Number	Location	Height (m)	Maximum Hourly Concentration (µg/m ³)	90.4th Percentile Concentration (24 hour) (µg/m ³)	Total Background and on site Percentile Concentration (µg/m ³)	Maximum 24-hour Concentration Resulting from Biomass Boiler (µg/m ³)
0	Grid Max	0	28.34	2.32	30.66	4.30
1	Window 1 SE	2.3	28.34	1.57	29.91	2.35
2	Window 2 SE	2.3	28.34	1.60	29.94	2.47
3	Window 3 SE	2.3	28.34	1.42	29.76	2.27
4	Window 4 SE	2.3	28.34	1.21	29.55	1.96
5	Window 5 SE	2.3	28.34	1.23	29.57	2.16
6	Window 1 E (Directly above EC)	6.35	28.34	1.27	29.61	1.77
7	Window 2 E (Directly above EC)	6.35	28.34	1.20	29.54	1.59
8	Corner East Building	2.3	28.34	1.26	29.60	1.78
9	Main Entrance 1	2.3	28.34	1.13	29.47	1.68
10	Main Entrance 2	2.3	28.34	0.99	29.33	1.56
11	Window 1 W	2.3	28.34	1.48	29.82	2.81
12	Window 2 W	2.3	28.34	1.93	30.27	3.14
13	Window 3 West	2.3	28.34	1.94	30.28	3.29
14	30 Frith Road	0	28.34	1.06	29.40	2.12

- 5.5.1. The short-term objective for 24-hour mean PM₁₀ concentrations is 50µg/m³ not to be exceeded more than 35 times per year to be achieved by the end of 2004. The modelling assessment results shown in Table 15 indicate that the highest increment in maximum 24-hourly mean PM₁₀ concentrations is 4.30µg/m³. The highest increment in the 90.4th percentile 24-hourly mean PM₁₀ concentrations is 2.32µg/m³.

- 5.5.2. Using an assumed background concentration of twice the background PM₁₀ annual mean, predicted total daily mean PM₁₀ concentrations with the biomass boiler in operation at full load remain within the objective.

Low Load

Table 16 Maximum Hourly and 90.4th Percentile 24 Hour PM₁₀ Concentrations Resulting from the Biomass Boiler on Site (Low Load)

Location Number	Location	Height (m)	Assumed Background Concentration (µg/m ³)	90.4 th Percentile Concentration (24 Hour) (µg/m ³)	Total Background and 90.4 th Percentile Concentration (µg/m ³)	Maximum Allowable Concentration Resulting from Biomass Boiler (µg/m ³)
0	Grid Max	0	28.34	0.44	28.78	0.78
1	Window 1 SE	2.3	28.34	0.32	28.66	0.45
2	Window 2 SE	2.3	28.34	0.31	28.65	0.44
3	Window 3 SE	2.3	28.34	0.28	28.62	0.43
4	Window 4 SE	2.3	28.34	0.24	28.58	0.41
5	Window 5 SE	2.3	28.34	0.27	28.61	0.45
6	Window 1 E (Directly above EC)	6.35	28.34	0.29	28.63	0.43
7	Window 2 E (Directly above EC)	6.35	28.34	0.27	28.61	0.42
8	Corner East Building	2.3	28.34	0.28	28.62	0.42
9	Main Entrance 1	2.3	28.34	0.24	28.58	0.39
10	Main Entrance 2	2.3	28.34	0.20	28.54	0.32
11	Window 1 W	2.3	28.34	0.24	28.58	0.50
12	Window 2 W	2.3	28.34	0.31	28.65	0.53
13	Window 3 West	2.3	28.34	0.31	28.65	0.59
14	30 Frith Road	0	28.34	0.27	28.61	0.53

- 5.5.3. The modelling assessment results shown in Table 156, indicate that the highest increment in maximum 24-hourly mean PM₁₀ concentrations is 0.78µg/m³. The highest increment in the 90.4th percentile 24-hourly mean PM₁₀ concentrations is 0.44µg/m³.
- 5.5.4. Using an assumed background concentration of twice the background PM₁₀ annual mean, predicted total daily mean PM₁₀ concentrations with the biomass boiler in operation at low load remain well within the objective.

5.6. Summary of Results

- 5.6.1. The modelled results shown in Table 9 to Table 16 (in Appendix B) show that, despite the operation of the biomass boiler, no exceedences of the long-term or short-term air quality objectives should be expected at any of the discrete receptors or within the receptor grid. Concentrations were highest when the biomass boiler was modelled to be running at full load.
- 5.6.2. The discrete receptors that were modelled to have the highest concentrations as a result of the biomass boiler were 'Window 1 SE', 'Window 1 E (Directly above EC)' and 'Main Entrance 1' (see Figure 4). Various heights at these receptors were modelled and the highest concentrations were found to be at the ground and first floor windows. This suggests that the emissions from the biomass boiler are grounding in the areas closest to the stack which despite not causing any exceedence of the air quality objectives, could cause a potential nuisance issue for staff and pupils using the eastern and south-eastern parts of the school building.

5.7. Mitigation Measures

- 5.7.1. The modelled results show that the highest concentrations of both NO₂ and PM₁₀ should be expected along the eastern and south-eastern side of the school building. The results also show that concentrations are expected to be higher during operation of the biomass boiler at full load as opposed to low load. Although the concentrations are said to be the highest along the eastern and south-eastern side of the school building, the expected annual, hourly and daily maximum concentrations of both NO₂ and PM₁₀ are well within the government objectives, during full and low load operation.
- 5.7.2. The modelled results show that the highest concentration of pollutants occur at ground and first floor windows.
- 5.7.3. A nuisance problem as a result of the biomass boiler has been identified at the school, particularly during start-up and shut down. Emission parameters from the biomass boiler during start up and shut down are not available. It is therefore not possible to model emissions associated with start-up and shut down. However, the short-term and transient nature of these emissions means that they are unlikely to cause pollutant concentrations to exceed the relevant objectives.
- 5.7.4. The timing of the start-up and shut-down of the biomass boiler could be managed to avoid future nuisance. If the biomass boiler start-up procedures could be started early in the morning before the school building is occupied, the creation of a nuisance may be avoided. Shut-down once the school building is unoccupied should also be considered for the same reasons detailed above.
- 5.7.5. The modelled results show that pollutant concentrations are reduced when the boiler is running at low load rather than starting up and shutting down the boiler each day. Keeping the biomass boiler running overnight at low load should also be considered to avoid nuisance.
- 5.7.6. A further mitigation measure that should be considered is strict adherence to boiler operating and maintenance procedures. For example, the use of wet fuel in the boiler could result in inefficient operation of the boiler and therefore possibly result in nuisance.

6. CONCLUSIONS

- 6.0.1. Computerised dispersion modelling of a biomass boiler located on site was undertaken at both full and low load operation. This was requested at the Regis School as a result of complaints of odour and smoke during start up and shut down operation of the boiler.
- 6.0.2. Modelled results show that an increase in the concentration of pollutants occurs as a result of the use of the biomass boiler. However, resulting concentrations combined with background levels of NO₂ and PM₁₀ are still well within the relevant objectives. Annual NO₂ concentrations at full load were modelled to have the greatest magnitude of change of large (at the grid max). However due to the existing low background concentrations, the impact on local air quality is expected to be slight adverse at the grid max and negligible at all discrete receptors. This is in line with EPUK guidance. All other modelled scenarios were shown to have a negligible impact on local air quality.
- 6.0.3. With the modelled results in mind, it has been recommended that the biomass boiler should either be kept running at low load overnight (as the concentrations of pollutants were lower at low load) or the start-up and shut-down of the biomass boiler should occur earlier or later respectively when the school building is unoccupied in order to reduce the impact of a potential nuisance issue.

FIGURES

FIGURE 1	SITE LOCATION PLAN
FIGURE 2	METEOROLOGICAL WIND ROSE FROM THORNEY ISLAND (in text)
FIGURE 3	AIR QUALITY MONITORING LOCATIONS
FIGURE 4	DISCRETE RECEPTOR LOCATIONS
FIGURE 5	ANNUAL NO ₂ CONCENTRATION CONTOUR (FULL LOAD)
FIGURE 6	ANNUAL NO ₂ CONCENTRATION CONTOUR (LOW LOAD)
FIGURE 7	99.8TH HOURLY PERCENTILE NO ₂ CONCENTRATION CONTOUR (FULL LOAD)
FIGURE 8	99.8TH HOURLY PERCENTILE NO ₂ CONCENTRATION CONTOUR (LOW LOAD)
FIGURE 9	ANNUAL PM ₁₀ CONCENTRATION CONTOUR (FULL LOAD)
FIGURE 10	ANNUAL PM ₁₀ CONCENTRATION CONTOUR (LOW LOAD)
FIGURE 11	90.4TH HOURLY PERCENTILE PM ₁₀ CONCENTRATION CONTOUR (FULL LOAD)
FIGURE 12	90.4TH HOURLY PERCENTILE PM ₁₀ CONCENTRATION CONTOUR (LOW LOAD)

FIGURE 1 SITE LOCATION PLAN



NOTES

Legend -

- School building
- Energy centre

Rev.	Drawn	Chkd.	Appvd	Date	Description
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Drawing Title
SITE LOCATION PLAN

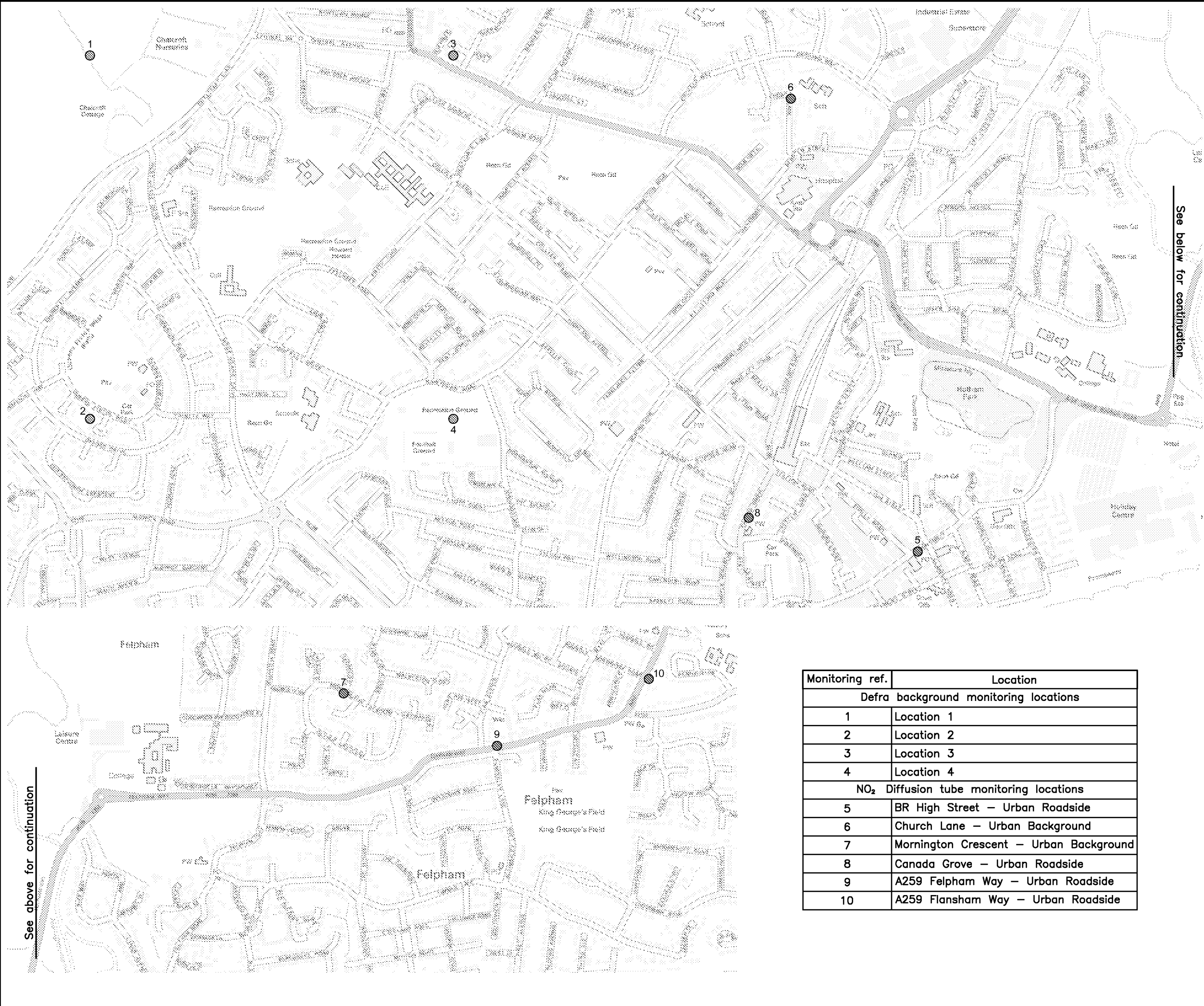


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scale (at A3)	date	drawn
1:10,000	NOV 12	AD
drg. no.	FIGURE 1	
rev.	-	

FIGURE 3 AIR QUALITY MONITORING LOCATIONS



NOTES

Legend -

- NO₂ diffusion tube monitoring locations
- ⊗ Defra background monitoring locations

Rev.	Drawn	Chkd.	Appvd.	Date	Description
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Drawing Title	AIR QUALITY MONITORING LOCATIONS
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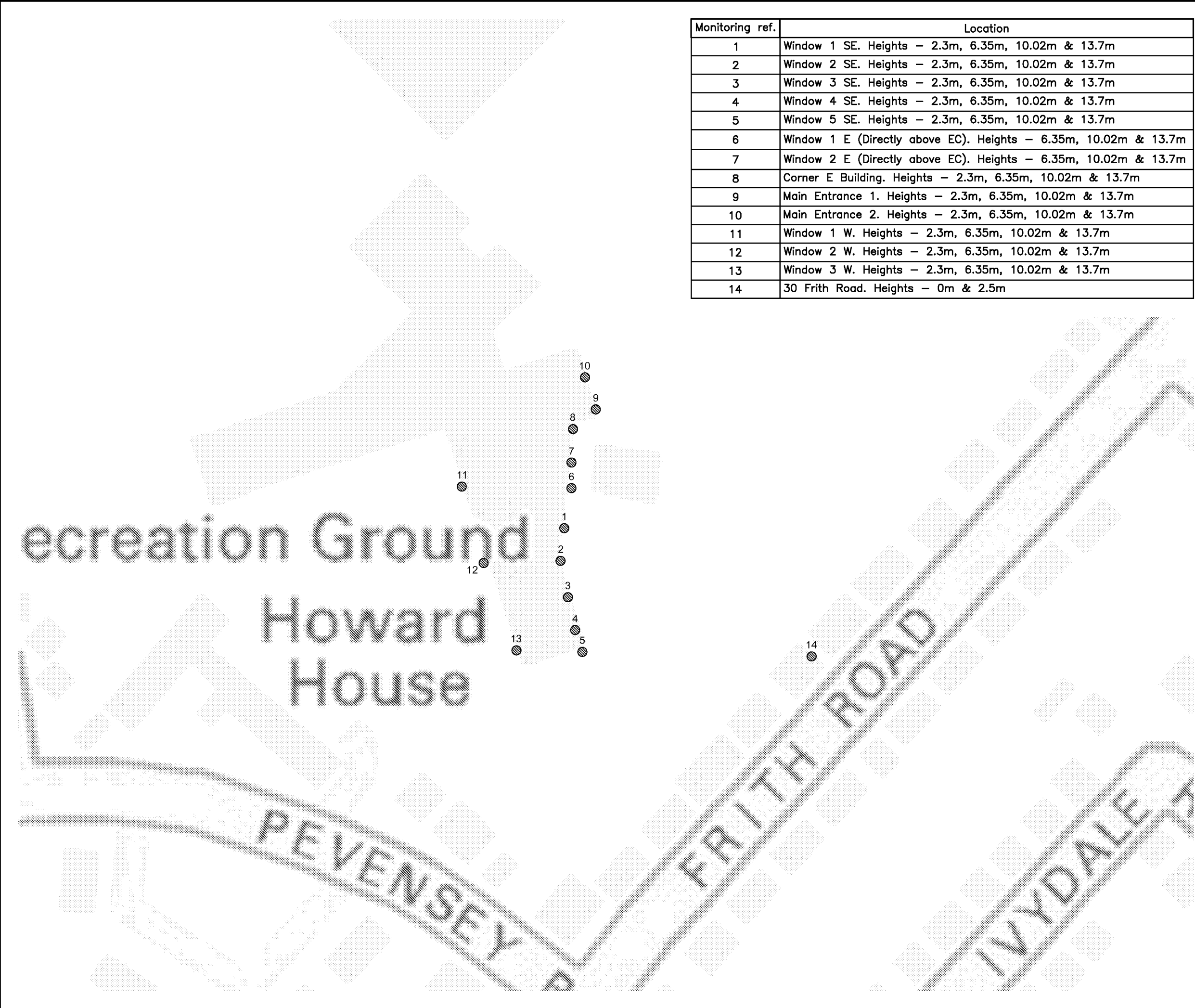


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drg. no.	rev.
FIGURE 3	-

FIGURE 4 DISCRETE RECEPTOR LOCATIONS



Monitoring ref.	Location
1	Window 1 SE. Heights – 2.3m, 6.35m, 10.02m & 13.7m
2	Window 2 SE. Heights – 2.3m, 6.35m, 10.02m & 13.7m
3	Window 3 SE. Heights – 2.3m, 6.35m, 10.02m & 13.7m
4	Window 4 SE. Heights – 2.3m, 6.35m, 10.02m & 13.7m
5	Window 5 SE. Heights – 2.3m, 6.35m, 10.02m & 13.7m
6	Window 1 E (Directly above EC). Heights – 6.35m, 10.02m & 13.7m
7	Window 2 E (Directly above EC). Heights – 6.35m, 10.02m & 13.7m
8	Corner E Building. Heights – 2.3m, 6.35m, 10.02m & 13.7m
9	Main Entrance 1. Heights – 2.3m, 6.35m, 10.02m & 13.7m
10	Main Entrance 2. Heights – 2.3m, 6.35m, 10.02m & 13.7m
11	Window 1 W. Heights – 2.3m, 6.35m, 10.02m & 13.7m
12	Window 2 W. Heights – 2.3m, 6.35m, 10.02m & 13.7m
13	Window 3 W. Heights – 2.3m, 6.35m, 10.02m & 13.7m
14	30 Frith Road. Heights – 0m & 2.5m

NOTES

Legend –

● Discrete receptor locations

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DISCRETE RECEPTOR LOCATIONS					
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scale (at A3)		date		drawn	
1:1000		NOV 12		AD	
drg. no.					rev.
FIGURE 4					-

FIGURE 5 ANNUAL NO₂ CONCENTRATION CONTOUR (FULL LOAD)



NOTES

Legend -

Concentration (ug/m³)	
0.1	
0.15	
0.25	
0.4	
0.8	
1.5	
2.5	

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Drawing Title					
ANNUAL NO ₂ CONCENTRATION CONTOUR (FULL LOAD)					

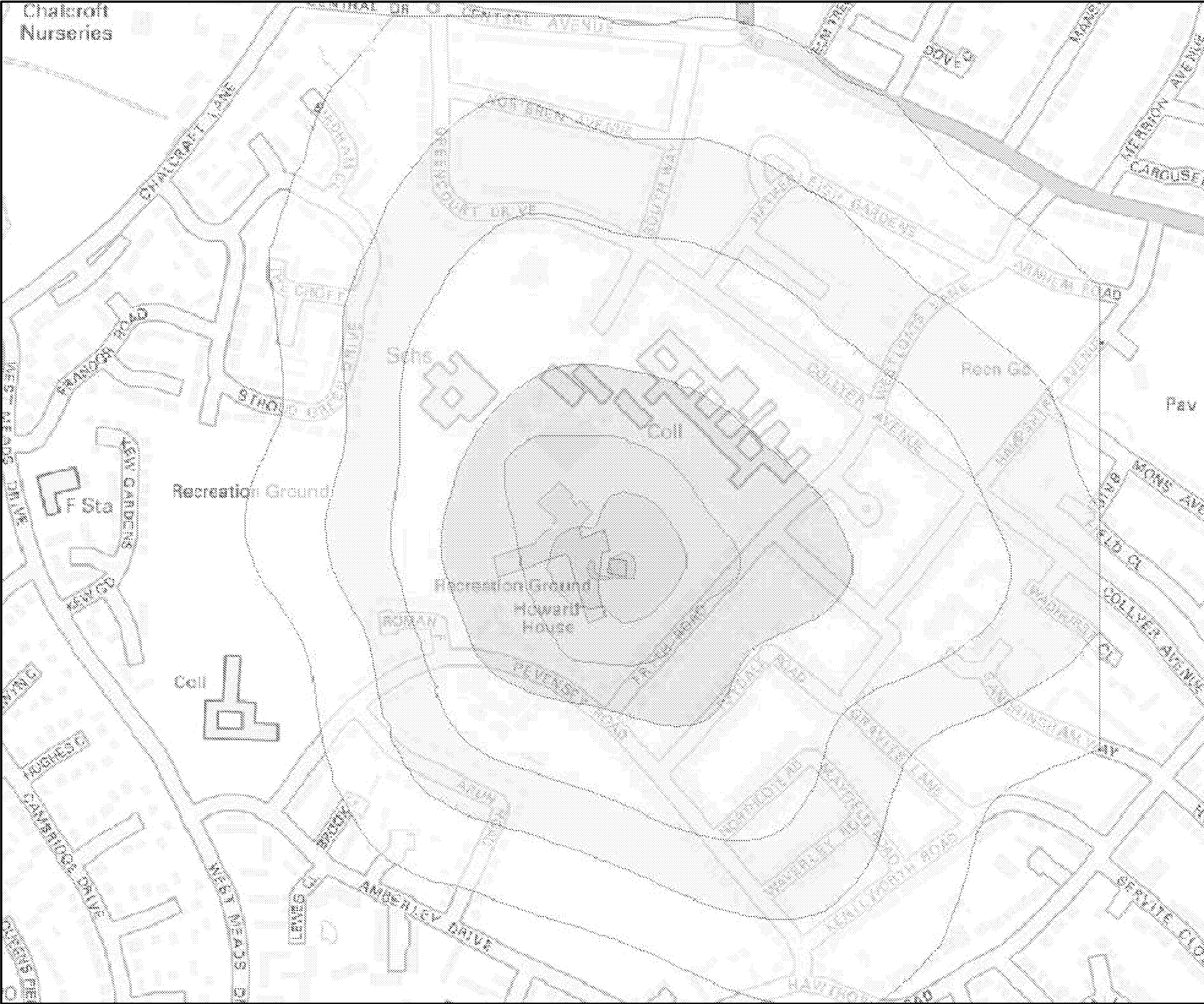


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scale (at A3) NTS	date NOV 12	drawn AD
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drg. no. FIGURE 5	rev. -
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FIGURE 6 ANNUAL NO₂ CONCENTRATION CONTOUR (LOW LOAD)



NOTES

Legend -

Concentration (ug/m³)	
0.06	
0.07	
0.1	
0.2	
0.4	
0.7	
1.2	

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scale (at A3)	date	drawn
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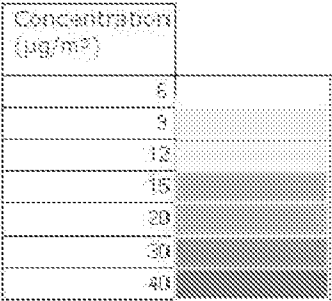
drg. no.	rev.
FIGURE 6	-

FIGURE 7 99.8TH HOURLY PERCENTILE NO₂ CONCENTRATION CONTOUR (FULL LOAD)



NOTES

Legend -



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Rev.	Drawn	Chkd.	Appvd.	Date	Description
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NTS	NOV 12	AD

drg. no.	rev.
FIGURE 7	-

FIGURE 8 99.8TH HOURLY PERCENTILE NO₂ CONCENTRATION CONTOUR (LOW LOAD)



NOTES

Legend -

Concentration (µg/m³)	
1	
1.7	
2.3	
3.9	
4.7	
8	
10	

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Rev.	Drawn	Chkd.	Appvd	Date	Description
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scale (at A3)	date	drawn
NTS	NOV 12	AD

drg. no.	rev.
FIGURE 8	-

FIGURE 9 ANNUAL PM10 CONCENTRATION CONTOUR (FULL LOAD)

Legend —

Concentration ($\mu\text{g}/\text{m}^3$)
0.02
0.04
0.06
0.1
0.2
0.4
0.7

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ANNUAL PM10
CONCENTRATION CONTOUR
(FULL LOAD)



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scale (at A3) NTS	date NOV 12	drawn AD
drg. no. FIGURE 9		rev. -

FIGURE 10 ANNUAL PM10 CONCENTRATION CONTOUR (LOW LOAD)

Legend —

Concentration ($\mu\text{g}/\text{m}^3$)	
0.01	
0.015	
0.02	
0.025	
0.035	
0.06	
0.18	

Rev.	1	Description
Drawn		
Chkd.		
Apprvd.		
Date		

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ANNUAL PM10
CONCENTRATION CONTOUR
(LOW LOAD)



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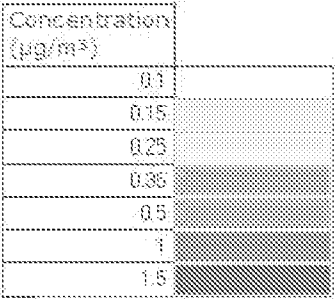
scale (at A3) NTS	date NOV 12	drawn AD
drg. no. FIGURE 10		rev. -

**FIGURE 11 90.4TH HOURLY PERCENTILE PM10 CONCENTRATION CONTOUR (FULL
LOAD)**



NOTES

Legend -



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Rev.	Drawn	Chkd.	Appvd	Date	Description
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Drawing Title					
90.4th DAILY PERCENTILE PM10 CONTOUR (FULL LOAD)					



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scale (at A3)	date	drawn
NTS	NOV 12	AD

drg. no.	rev.
FIGURE 11	-

**FIGURE 12 90.4TH HOURLY PERCENTILE PM10 CONCENTRATION CONTOUR (LOW
LOAD)**

Legend —

Concentration ($\mu\text{g}/\text{m}^3$)	
0.015	
0.02	
0.03	
0.05	
0.1	
0.2	
0.3	

Rev.	1	
Drawn		
Chkd.		
Apprvd.		
Date		
Description		

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90.4th DAILY PERCENTILE
PM10 CONTOUR
(LOW LOAD)



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scale (at A3)	date	drawn
NTS	NOV 12	AD
drg. no.		rev.
FIGURE 12		-

APPENDICES

APPENDIX A BREEZE AERMOD DETAILS

APPENDIX B FULL MODELLED RESULTS TABLES

APPENDIX A

BREEZE AERMOD DETAILS

Breeze Aermod is a computational dispersion model that is used to model emissions from a variety of line, point, area, volume and flare sources in a variety of terrains. The model uses site specific digital hourly meteorological data to predict the dispersion of emissions. These emissions and likely pollutant plumes can be subsequently analysed using other Breeze software such as 3D Analyst (as undertaken within this assessment).

The model can be used to predict pollutant concentrations at specific receptors or defined receptor grids within the model. Pollutants modelled by the Breeze Aermod include carbon monoxide, particulate matter, oxides of nitrogen and nitrogen dioxide. Model outputs can calculate pollutant emissions over a range of timescales from 1 hour to annual concentrations.

APPENDIX B

FULL MODELLED RESULTS TABLES

*Table 17 Annual Mean NO₂ Concentrations Resulting from the Biomass Boiler on Site
(Full Load)*

Location	Background Concentration (µg/m ³)	Without Biomass Boiler Concentration (µg/m ³)	Impact of Biomass Boiler (µg/m ³)	Total Background Concentration and Biomass Boiler (µg/m ³)	Increase in % of Observed (µg)	Qualitative Change	Impact Description
Grid Max	0	15	4.03	19.03	10.07	Large	Slight Adverse
Window 1 SE	2.30	15	3.68	18.68	9.21	Medium	Negligible
Window 1 SE	6.35	15	3.14	18.14	7.84	Medium	Negligible
Window 1 SE	10.02	15	2.59	17.59	6.49	Medium	Negligible
Window 1 SE	13.70	15	2.23	17.23	5.57	Medium	Negligible
Window 2 SE	2.30	15	3.19	18.19	7.97	Medium	Negligible
Window 2 SE	6.35	15	2.71	17.71	6.77	Medium	Negligible
Window 2 SE	10.02	15	2.23	17.23	5.57	Medium	Negligible
Window 2 SE	13.70	15	1.91	16.91	4.78	Small	Negligible
Window 3 SE	2.30	15	2.45	17.45	6.11	Medium	Negligible
Window 3 SE	6.35	15	2.07	17.07	5.18	Medium	Negligible
Window 3 SE	10.02	15	1.70	16.70	4.26	Small	Negligible
Window 3 SE	13.70	15	1.46	16.46	3.65	Small	Negligible
Window 4 SE	2.30	15	1.79	16.79	4.47	Small	Negligible
Window 4 SE	6.35	15	1.51	16.51	3.78	Small	Negligible
Window 4 SE	10.02	15	1.24	16.24	3.11	Small	Negligible
Window 4 SE	13.70	15	1.07	16.07	2.66	Small	Negligible
Window 5 SE	2.30	15	1.54	16.54	3.84	Small	Negligible
Window 5 SE	6.35	15	1.30	16.30	3.26	Small	Negligible
Window 5 SE	10.02	15	1.09	16.09	2.74	Small	Negligible
Window 5 SE	13.70	15	0.96	15.96	2.40	Small	Negligible
Window 1 E (Directly above EC)	6.35	15	3.36	18.36	8.41	Medium	Negligible
Window 1 E (Directly above EC)	10.02	15	2.82	17.82	7.04	Medium	Negligible

Location	Height (m)	Annual Average Hourly Average Concentration (µg/m ³)	Annual Average Hourly Average (µg/m ³)	Total Background Concentration and Transport Factor (µg/m ³)	Incremental Concentration (µg/m ³)	Exposure Category	Impact Description
EC)							
Window 1 E (Directly above EC)	13.70	15	2.42	17.42	6.05	Medium	Negligible
Window 2 E (Directly above EC)	6.35	15	3.31	18.31	8.27	Medium	Negligible
Window 2 E (Directly above EC)	10.02	15	2.75	17.75	6.89	Medium	Negligible
Window 2 E (Directly above EC)	13.70	15	2.37	17.37	5.92	Medium	Negligible
Corner East Building	2.30	15	3.54	18.54	8.84	Medium	Negligible
Corner East Building	6.35	15	3.01	18.01	7.53	Medium	Negligible
Corner East Building	10.02	15	2.49	17.49	6.23	Medium	Negligible
Corner East Building	13.70	15	2.14	17.14	5.34	Medium	Negligible
Main Entrance 1	2.30	15	3.15	18.15	7.86	Medium	Negligible
Main Entrance 1	6.35	15	2.68	17.68	6.71	Medium	Negligible
Main Entrance 1	10.02	15	2.22	17.22	5.55	Medium	Negligible
Main Entrance 1	13.70	15	1.90	16.90	4.75	Small	Negligible
Main Entrance 2	2.30	15	2.70	17.70	6.76	Medium	Negligible
Main Entrance 2	6.35	15	2.30	17.30	5.75	Medium	Negligible
Main Entrance 2	10.02	15	1.89	16.89	4.74	Small	Negligible
Main Entrance 2	13.70	15	1.62	16.62	4.05	Small	Negligible

Location	Height (m)	Without Biomass Boiler Concentration (µg/m³)	Reported Biomass Boiler (µg/m³)	Total Background Concentration and Biomass Boiler (µg/m³)	Incremental % of Objective (%)	Magnitude of Change	Impact Description
Window 1 W	2.30	15	3.27	18.27	8.16	Medium	Negligible
Window 1 W	6.35	15	2.76	17.76	6.91	Medium	Negligible
Window 1 W	10.02	15	2.27	17.27	5.68	Medium	Negligible
Window 1 W	13.70	15	1.94	16.94	4.86	Small	Negligible
Window 2 W	2.30	15	3.08	18.08	7.71	Medium	Negligible
Window 2 W	6.35	15	2.61	17.61	6.52	Medium	Negligible
Window 2 W	10.02	15	2.14	17.14	5.35	Medium	Negligible
Window 2 W	13.70	15	1.83	16.83	4.58	Small	Negligible
Window 3 West	2.30	15	1.90	16.90	4.76	Small	Negligible
Window 3 West	6.35	15	1.60	16.60	4.01	Small	Negligible
Window 3 West	10.02	15	1.32	16.32	3.29	Small	Negligible
Window 3 West	13.70	15	1.13	16.13	2.82	Small	Negligible
30 Frith Road	0.00	15	1.52	16.52	3.79	Small	Negligible
30 Frith Road	2.50	15	1.39	16.39	3.49	Small	Negligible

Table 18 Annual Mean NO2 Concentrations Resulting from the Biomass Boiler on Site (Low Load)

Location	Height (m)	Without Biomass Boiler Concentration (µg/m³)	Reported Biomass Boiler (µg/m³)	Total Background Concentration and Biomass Boiler (µg/m³)	Incremental % of Objective (%)	Magnitude of Change	Impact Description
Grid Max	0	15	1.33	16.33	3.32	Small	Negligible
Window 1 SE	2.3	15	1.25	16.25	3.12	Small	Negligible
Window 1 SE	6.35	15	1.07	16.07	2.66	Small	Negligible
Window 1 SE	10.02	15	0.88	15.88	2.19	Small	Negligible
Window 1 SE	13.7	15	0.75	15.75	1.87	Small	Negligible
Window 2 SE	2.3	15	1.07	16.07	2.69	Small	Negligible
Window 2 SE	6.35	15	0.91	15.91	2.28	Small	Negligible

Location	Height (m)	Without Heating Dilution Concentration (µg/m³)	Incremental Heating Dilution (µg/m³)	Total Background Concentration and Heating Dilution (µg/m³)	Increment of CO ₂ Dilution (ppm)	Magnitude of Change	Impact Classification
Window 2 SE	10.02	15	0.75	15.75	1.87	Small	Negligible
Window 2 SE	13.7	15	0.64	15.64	1.60	Small	Negligible
Window 3 SE	2.3	15	0.83	15.83	2.07	Small	Negligible
Window 3 SE	6.35	15	0.70	15.70	1.75	Small	Negligible
Window 3 SE	10.02	15	0.58	15.58	1.44	Small	Negligible
Window 3 SE	13.7	15	0.49	15.49	1.23	Small	Negligible
Window 4 SE	2.3	15	0.61	15.61	1.53	Small	Negligible
Window 4 SE	6.35	15	0.52	15.52	1.30	Small	Negligible
Window 4 SE	10.02	15	0.43	15.43	1.06	Small	Negligible
Window 4 SE	13.7	15	0.36	15.36	0.91	Imperceptible	Negligible
Window 5 SE	2.3	15	0.55	15.55	1.38	Small	Negligible
Window 5 SE	6.35	15	0.46	15.46	1.16	Small	Negligible
Window 5 SE	10.02	15	0.39	15.39	0.97	Imperceptible	Negligible
Window 5 SE	13.7	15	0.34	15.34	0.84	Imperceptible	Negligible
Window 1 E (Directly above EC)	6.35	15	1.15	16.15	2.88	Small	Negligible
Window 1 E (Directly above EC)	10.02	15	0.95	15.95	2.37	Small	Negligible
Window 1 E (Directly above EC)	13.7	15	0.81	15.81	2.01	Small	Negligible
Window 2 E (Directly above EC)	6.35	15	1.12	16.12	2.80	Small	Negligible

Location	Height (m)	Without Domestic Boiler Concentration (µg/m ³)	Incremental Domestic Boiler (µg/m ³)	Total Background Concentration and Domestic Boiler (µg/m ³)	Increment of NO ₂ Dioxide (ppb)	Magnitude of Change	Impact Description
EC)							
Window 2 E (Directly above EC)	10.02	15	0.92	15.92	2.31	Small	Negligible
Window 2 E (Directly above EC)	13.7	15	0.78	15.78	1.96	Small	Negligible
Corner East Building	2.3	15	1.17	16.17	2.92	Small	Negligible
Corner East Building	6.35	15	1.00	16.00	2.49	Small	Negligible
Corner East Building	10.02	15	0.82	15.82	2.05	Small	Negligible
Corner East Building	13.7	15	0.70	15.70	1.75	Small	Negligible
Main Entrance 1	2.3	15	1.05	16.05	2.63	Small	Negligible
Main Entrance 1	6.35	15	0.90	15.90	2.24	Small	Negligible
Main Entrance 1	10.02	15	0.74	15.74	1.84	Small	Negligible
Main Entrance 1	13.7	15	0.63	15.63	1.57	Small	Negligible
Main Entrance 2	2.3	15	0.86	15.86	2.15	Small	Negligible
Main Entrance 2	6.35	15	0.73	15.73	1.82	Small	Negligible
Main Entrance 2	10.02	15	0.60	15.60	1.50	Small	Negligible
Main Entrance 2	13.7	15	0.51	15.51	1.28	Small	Negligible
Window 1	2.3	15	0.97	15.97	2.42	Small	Negligible

Location	Height (m)	Without Biomass Boiler Concentration ($\mu\text{g}/\text{m}^3$)	Impact of Biomass Boiler ($\mu\text{g}/\text{m}^3$)	Total Background Concentration and Biomass Boiler ($\mu\text{g}/\text{m}^3$)	Increase as % of Objective (%)	Magnitude of Change	Impact Description
W							
Window 1 W	6.35	15	0.82	15.82	2.05	Small	Negligible
Window 1 W	10.02	15	0.67	15.67	1.69	Small	Negligible
Window 1 W	13.7	15	0.58	15.58	1.44	Small	Negligible
Window 2 W	2.3	15	0.94	15.94	2.34	Small	Negligible
Window 2 W	6.35	15	0.79	15.79	1.98	Small	Negligible
Window 2 W	10.02	15	0.65	15.65	1.62	Small	Negligible
Window 2 W	13.7	15	0.56	15.56	1.39	Small	Negligible
Window 3 West	2.3	15	0.58	15.58	1.45	Small	Negligible
Window 3 West	6.35	15	0.49	15.49	1.22	Small	Negligible
Window 3 West	10.02	15	0.40	15.40	1.00	Small	Negligible
Window 3 West	13.7	15	0.34	15.34	0.86	Imperceptible	Negligible
30 Frith Road	0	15	0.58	15.58	1.45	Small	Negligible
30 Frith Road	2.5	15	0.53	15.53	1.34	Small	Negligible

Table 19 Maximum and 99.8th Percentile Hourly NO₂ Concentrations Resulting from the Biomass Boiler on Site (Full Load)

Location	Height (m)	Without Biomass Boiler Concentration ($\mu\text{g}/\text{m}^3$)	Impact of Biomass Boiler ($\mu\text{g}/\text{m}^3$)	Total Background Concentration and Biomass Boiler ($\mu\text{g}/\text{m}^3$)	Increase as % of Objective (%)	Magnitude of Change	Impact Description	Per 1 hour Concentration ($\mu\text{g}/\text{m}^3$)
Grid Max	0	30	50.74	80.74	25.37	Large	Slight Adverse	72.92
Window 1 SE	2.30	30	19.26	49.26	9.63	Large	Slight Adverse	27.26
Window 1 SE	6.35	30	16.82	46.82	8.41	Large	Slight Adverse	23.83
Window 1	10.02	30	14.38	44.38	7.19	Medium	Negligible	19.86

THE REGIS SCHOOL LOCAL AIR QUALITY ASSESSMENT

RAMBOLL

Location	Temperature (°C)	Wind Speed (m/s)	Relative Humidity (%)	Wind Direction (°)	Wind Speed (m/s)	Wind Direction (°)	Wind Speed (m/s)	Wind Direction (°)	Wind Speed (m/s)
SE									
Window 1 SE	13.70	30	12.50	42.50	6.25	Medium	Negligible	16.76	
Window 2 SE	2.30	30	19.82	49.82	9.91	Large	Slight Adverse	28.17	
Window 2 SE	6.35	30	17.94	47.94	8.97	Large	Slight Adverse	24.62	
Window 2 SE	10.02	30	15.23	45.23	7.62	Large	Slight Adverse	20.53	
Window 2 SE	13.70	30	12.93	42.93	6.47	Medium	Negligible	17.32	
Window 3 SE	2.30	30	18.98	48.98	9.49	Large	Slight Adverse	25.21	
Window 3 SE	6.35	30	16.58	46.58	8.29	Large	Slight Adverse	22.03	
Window 3 SE	10.02	30	13.98	43.98	6.99	Medium	Negligible	18.98	
Window 3 SE	13.70	30	11.89	41.89	5.94	Medium	Negligible	16.29	
Window 4 SE	2.30	30	16.79	46.79	8.40	Large	Slight Adverse	21.80	
Window 4 SE	6.35	30	14.76	44.76	7.38	Medium	Negligible	19.41	
Window 4 SE	10.02	30	12.82	42.82	6.41	Medium	Negligible	16.89	
Window 4 SE	13.70	30	10.87	40.87	5.44	Medium	Negligible	14.49	
Window 5 SE	2.30	30	16.58	46.58	8.29	Large	Slight Adverse	27.90	
Window 5 SE	6.35	30	14.57	44.57	7.28	Large	Slight Adverse	28.46	
Window 5 SE	10.02	30	13.85	43.85	6.92	Large	Slight Adverse	30.19	
Window 5 SE	13.70	30	12.99	42.99	6.49	Large	Slight Adverse	33.56	
Window 1 E (Directly above EC)	6.35	30	16.73	46.73	8.36	Large	Slight Adverse	21.33	
Window 1 E (Directly above EC)	10.02	30	15.56	45.56	7.78	Large	Slight Adverse	21.86	
Window 1 E (Directly above EC)	13.70	30	14.67	44.67	7.33	Large	Slight Adverse	22.82	

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Location	Height (m)	Wind Speed (m/s)	Without Corner Building Contribution (µg/m ³)	Without Building Contribution (µg/m ³)	Without Road Contribution (µg/m ³)	Without Other Building Contribution (µg/m ³)	Without Other Contribution (µg/m ³)	Without Other Contribution (µg/m ³)	Without Other Contribution (µg/m ³)
Window 2 E (Directly above EC)	6.35	30		16.46	46.46	8.23	Large	Slight Adverse	22.37
Window 2 E (Directly above EC)	10.02	30		14.12	44.12	7.06	Medium	Negligible	18.65
Window 2 E (Directly above EC)	13.70	30		13.05	43.05	6.52	Medium	Negligible	18.02
Corner East Building	2.30	30		18.38	48.38	9.19	Large	Slight Adverse	27.61
Corner East Building	6.35	30		16.06	46.06	8.03	Large	Slight Adverse	24.13
Corner East Building	10.02	30		13.47	43.47	6.73	Large	Slight Adverse	20.12
Corner East Building	13.70	30		11.53	41.53	5.76	Medium	Negligible	16.97
Main Entrance 1	2.30	30		18.25	48.25	9.13	Large	Slight Adverse	31.73
Main Entrance 1	6.35	30		16.51	46.51	8.26	Large	Slight Adverse	27.73
Main Entrance 1	10.02	30		14.37	44.37	7.18	Large	Slight Adverse	23.12
Main Entrance 1	13.70	30		12.33	42.33	6.16	Medium	Negligible	19.50
Main Entrance 2	2.30	30		20.52	50.52	10.26	Large	Slight Adverse	30.08
Main Entrance 2	6.35	30		18.40	48.40	9.20	Large	Slight Adverse	26.29
Main Entrance 2	10.02	30		16.01	46.01	8.00	Large	Slight Adverse	21.91
Main Entrance 2	13.70	30		13.73	43.73	6.87	Medium	Negligible	18.49
Window 1 W	2.30	30		19.29	49.29	9.64	Large	Slight Adverse	23.61
Window 1 W	6.35	30		17.20	47.20	8.60	Large	Slight Adverse	20.63
Window 1 W	10.02	30		14.79	44.79	7.39	Medium	Negligible	17.20
Window 1 W	13.70	30		12.69	42.69	6.34	Medium	Negligible	14.51
Window 2 W	2.30	30		26.67	56.67	13.33	Large	Slight Adverse	39.02
Window 2 W	6.35	30		23.78	53.78	11.89	Large	Slight Adverse	34.10

Location	Height (m)	Without Biomass Boiler Concentration (µg/m³)	Impact of biomass boiler (µg/m³)	Total Background Concentration and biomass boiler (µg/m³)	Increment to 99.9th percentile (µg/m³)	Magnitude of Change	Impact Description	Max 1 hour Concentration (µg/m³)
Window 2 W	10.02	30	20.56	50.56	10.28	Large	Slight Adverse	28.43
Window 2 W	13.70	30	17.62	47.62	8.81	Large	Slight Adverse	23.98
Window 3 West	2.30	30	27.72	57.72	13.86	Large	Slight Adverse	37.60
Window 3 West	6.35	30	24.22	54.22	12.11	Large	Slight Adverse	32.86
Window 3 West	10.02	30	20.42	50.42	10.21	Large	Slight Adverse	27.66
Window 3 West	13.70	30	17.43	47.43	8.71	Large	Slight Adverse	23.73
30 Frith Road	0.00	30	27.30	57.30	13.65	Large	Slight Adverse	46.81
30 Frith Road	2.50	30	27.14	57.14	13.57	Large	Slight Adverse	46.27

Table 20 Maximum and 99.9th Percentile Hourly NO2 Concentrations Resulting from the Biomass Boiler on Site (Low Load)

Location	Height (m)	Without Biomass Boiler Concentration (µg/m³)	Impact of biomass boiler (µg/m³)	Total Background Concentration and biomass boiler (µg/m³)	Increment to 99.9th percentile (µg/m³)	Magnitude of Change	Impact Description	Max 1 hour Concentration (µg/m³)
Grid Max		30	13.71	43.71	6.86	Medium	Negligible	27.21
Window 1 SE	2.3	30	8.98	38.98	4.49	Small	Negligible	9.72
Window 1 SE	6.35	30	7.85	37.85	3.93	Small	Negligible	8.50
Window 1 SE	10.02	30	6.55	36.55	3.27	Small	Negligible	7.08
Window 1 SE	13.7	30	5.53	35.53	2.76	Small	Negligible	5.97
Window 2 SE	2.3	30	8.27	38.27	4.14	Small	Negligible	9.98
Window 2 SE	6.35	30	7.25	37.25	3.62	Small	Negligible	8.72
Window 2 SE	10.02	30	6.06	36.06	3.03	Small	Negligible	7.27
Window 2 SE	13.7	30	5.12	35.12	2.56	Small	Negligible	6.13
Window 3	2.3	30	7.55	37.55	3.77	Small	Negligible	9.21

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Location	Height (m)	Without Roads Below Concentration (µg/m³)	Impact of Roads Below Concentration (µg/m³)	Total Background Concentration and Roads Below (10/100) (µg/m³)	Incremental Concentration (µg/m³)	Magnitude of Change	Impact Description	With Roads Concentration (10/100) (µg/m³)
SE								
Window 3 SE	6.35	30	6.60	36.60	3.30	Small	Negligible	8.05
Window 3 SE	10.02	30	5.51	35.51	2.75	Small	Negligible	6.72
Window 3 SE	13.7	30	4.65	34.65	2.32	Small	Negligible	5.67
Window 4 SE	2.3	30	6.64	36.64	3.32	Small	Negligible	9.42
Window 4 SE	6.35	30	5.83	35.83	2.92	Small	Negligible	8.24
Window 4 SE	10.02	30	4.99	34.99	2.50	Small	Negligible	6.87
Window 4 SE	13.7	30	4.21	34.21	2.11	Small	Negligible	5.80
Window 5 SE	2.3	30	6.80	36.80	3.40	Small	Negligible	13.90
Window 5 SE	6.35	30	6.34	36.34	3.17	Small	Negligible	13.95
Window 5 SE	10.02	30	6.52	36.52	3.26	Small	Negligible	14.35
Window 5 SE	13.7	30	5.64	35.64	2.82	Small	Negligible	14.90
Window 1 E (Directly above EC)	6.35	30	8.12	38.12	4.06	Small	Negligible	9.67
Window 1 E (Directly above EC)	10.02	30	6.77	36.77	3.38	Small	Negligible	8.06
Window 1 E (Directly above EC)	13.7	30	5.71	35.71	2.85	Small	Negligible	6.80
Window 2 E (Directly above EC)	6.35	30	7.78	37.78	3.89	Small	Negligible	9.65
Window 2 E (Directly above EC)	10.02	30	6.48	36.48	3.24	Small	Negligible	8.04
Window 2 E (Directly above EC)	13.7	30	5.47	35.47	2.74	Small	Negligible	6.79
Corner East Building	2.3	30	7.58	37.58	3.79	Small	Negligible	11.89
Corner East Building	6.35	30	6.65	36.65	3.33	Small	Negligible	10.39

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Location	Height (m)	Without Source Baffle Concentration (µg/m ³)	Impact of Source Baffle (µg/m ³)	Total Background Concentration and Baffle Total (µg/m ³)	Incremental Concentration (µg/m ³)	Magnitude of Change	Forest Absorption	Final Total Concentration (µg/m ³)
Corner East Building	10.02	30	5.76	35.76	2.88	Small	Negligible	8.66
Corner East Building	13.7	30	4.91	34.91	2.45	Small	Negligible	7.31
Main Entrance 1	2.3	30	8.15	38.15	4.07	Small	Negligible	13.67
Main Entrance 1	6.35	30	7.28	37.28	3.64	Small	Negligible	11.94
Main Entrance 1	10.02	30	6.07	36.07	3.04	Small	Negligible	9.96
Main Entrance 1	13.7	30	5.12	35.12	2.56	Small	Negligible	8.40
Main Entrance 2	2.3	30	7.93	37.93	3.96	Small	Negligible	12.96
Main Entrance 2	6.35	30	6.82	36.82	3.41	Small	Negligible	11.32
Main Entrance 2	10.02	30	5.94	35.94	2.97	Small	Negligible	9.44
Main Entrance 2	13.7	30	5.04	35.04	2.52	Small	Negligible	7.96
Window 1 W	2.3	30	5.97	35.97	2.99	Small	Negligible	7.30
Window 1 W	6.35	30	5.25	35.25	2.63	Small	Negligible	6.38
Window 1 W	10.02	30	4.40	34.40	2.20	Small	Negligible	5.32
Window 1 W	13.7	30	3.72	33.72	1.86	Small	Negligible	4.49
Window 2 W	2.3	30	8.29	38.29	4.14	Small	Negligible	13.17
Window 2 W	6.35	30	7.24	37.24	3.62	Small	Negligible	11.51
Window 2 W	10.02	30	6.05	36.05	3.03	Small	Negligible	9.60
Window 2 W	13.7	30	5.11	35.11	2.56	Small	Negligible	8.10
Window 3 West	2.3	30	8.82	38.82	4.41	Small	Negligible	13.32
Window 3 West	6.35	30	8.03	38.03	4.01	Small	Negligible	11.64
Window 3 West	10.02	30	6.72	36.72	3.36	Small	Negligible	9.70
Window 3 West	13.7	30	5.67	35.67	2.84	Small	Negligible	8.19

Location	Height (m)	Without Biomass Boiler Concentration (µg/m ³)	Impact of Biomass Boiler (µg/m ³)	Total Background Concentration and Biomass Boiler (µg/m ³)	Increment % of Objective (%)	Magnitude of Change	Impact Description	PM ₁₀ Year Concentration (µg/m ³)
30 Frith Road	0	30	12.61	42.61	6.30	Medium	Negligible	21.16
30 Frith Road	2.5	30	12.46	42.46	6.23	Medium	Negligible	20.84

Table 21 Annual Mean PM₁₀ Concentrations Resulting from the Biomass Boiler on Site (Full Load)

Location	Height (m)	Without Biomass Boiler Concentration (µg/m ³)	Impact of Biomass Boiler (µg/m ³)	Total Background Concentration and Biomass Boiler (µg/m ³)	Increment % of Objective (%)	Magnitude of Change	Impact Description
Grid Max	0	14.17	1.06	15.23	2.65	Small	Negligible
Window 1 SE	2.3	14.17	0.97	15.14	2.42	Small	Negligible
Window 1 SE	6.35	14.17	0.83	15.00	2.06	Small	Negligible
Window 1 SE	10.02	14.17	0.68	14.85	1.71	Small	Negligible
Window 1 SE	13.7	14.17	0.59	14.76	1.47	Small	Negligible
Window 2 SE	2.3	14.17	0.84	15.01	2.10	Small	Negligible
Window 2 SE	6.35	14.17	0.71	14.88	1.78	Small	Negligible
Window 2 SE	10.02	14.17	0.59	14.76	1.47	Small	Negligible
Window 2 SE	13.7	14.17	0.50	14.67	1.26	Small	Negligible
Window 3 SE	2.3	14.17	0.64	14.81	1.61	Small	Negligible
Window 3 SE	6.35	14.17	0.55	14.72	1.36	Small	Negligible
Window 3 SE	10.02	14.17	0.45	14.62	1.12	Small	Negligible
Window 3 SE	13.7	14.17	0.38	14.55	0.96	Imperceptible	Negligible
Window 4 SE	2.3	14.17	0.47	14.64	1.18	Small	Negligible
Window 4 SE	6.35	14.17	0.40	14.57	1.00	Small	Negligible
Window 4	10.02	14.17	0.33	14.50	0.82	Imperceptible	Negligible

Location	Measured Concentration (µg/m ³)	Without Building Concentration (µg/m ³)	Incremental Building Concentration (µg/m ³)	Total Background Concentration and Building Emission (µg/m ³)	Incremental Concentration (µg/m ³)	Impairment to Classroom	Impact on School
SE							
Window 4 SE	13.7	14.17	0.28	14.45	0.70	Imperceptible	Negligible
Window 5 SE	2.3	14.17	0.40	14.57	1.01	Small	Negligible
Window 5 SE	6.35	14.17	0.34	14.51	0.86	Imperceptible	Negligible
Window 5 SE	10.02	14.17	0.29	14.46	0.72	Imperceptible	Negligible
Window 5 SE	13.7	14.17	0.25	14.42	0.63	Imperceptible	Negligible
Window 1 E (Directly above EC)	6.35	14.17	0.89	15.06	2.21	Small	Negligible
Window 1 E (Directly above EC)	10.02	14.17	0.74	14.91	1.85	Small	Negligible
Window 1 E (Directly above EC)	13.7	14.17	0.64	14.81	1.59	Small	Negligible
Window 2 E (Directly above EC)	6.35	14.17	0.87	15.04	2.18	Small	Negligible
Window 2 E (Directly above EC)	10.02	14.17	0.72	14.89	1.81	Small	Negligible
Window 2 E (Directly above EC)	13.7	14.17	0.62	14.79	1.56	Small	Negligible
Corner East Building	2.3	14.17	0.93	15.10	2.33	Small	Negligible
Corner East Building	6.35	14.17	0.79	14.96	1.98	Small	Negligible
Corner East Building	10.02	14.17	0.66	14.83	1.64	Small	Negligible
Corner East Building	13.7	14.17	0.56	14.73	1.40	Small	Negligible
Main Entrance 1	2.3	14.17	0.83	15.00	2.07	Small	Negligible
Main Entrance 1	6.35	14.17	0.71	14.88	1.76	Small	Negligible
Main Entrance 1	10.02	14.17	0.58	14.75	1.46	Small	Negligible
Main Entrance 1	13.7	14.17	0.50	14.67	1.25	Small	Negligible

Location	Height (m)	Without Biomass Boiler Contribution (µg/m³)	Impact of Biomass Boiler (µg/m³)	Total Background Concentration and Biomass Boiler (µg/m³)	Incremental Impact of Biomass Boiler (µg/m³)	Magnitude of Change	Impact Description
Main Entrance 2	2.3	14.17	0.71	14.88	1.78	Small	Negligible
Main Entrance 2	6.35	14.17	0.61	14.78	1.51	Small	Negligible
Main Entrance 2	10.02	14.17	0.50	14.67	1.25	Small	Negligible
Main Entrance 2	13.7	14.17	0.43	14.60	1.07	Small	Negligible
Window 1 W	2.3	14.17	0.86	15.03	2.15	Small	Negligible
Window 1 W	6.35	14.17	0.73	14.90	1.82	Small	Negligible
Window 1 W	10.02	14.17	0.60	14.77	1.49	Small	Negligible
Window 1 W	13.7	14.17	0.51	14.68	1.28	Small	Negligible
Window 2 W	2.3	14.17	0.81	14.98	2.03	Small	Negligible
Window 2 W	6.35	14.17	0.69	14.86	1.71	Small	Negligible
Window 2 W	10.02	14.17	0.56	14.73	1.41	Small	Negligible
Window 2 W	13.7	14.17	0.48	14.65	1.20	Small	Negligible
Window 3 West	2.3	14.17	0.50	14.67	1.25	Small	Negligible
Window 3 West	6.35	14.17	0.42	14.59	1.06	Small	Negligible
Window 3 West	10.02	14.17	0.35	14.52	0.87	Imperceptible	Negligible
Window 3 West	13.7	14.17	0.30	14.47	0.74	Imperceptible	Negligible
30 Frith Road	0	14.17	0.40	14.57	1.00	Small	Negligible
30 Frith Road	2.5	14.17	0.37	14.54	0.92	Imperceptible	Negligible

Table 22 Annual Mean PM10 Concentrations Resulting from the Biomass Boiler on Site (Low Load)

Location	Height (m)	Without Biomass Boiler Contribution (µg/m³)	Impact of Biomass Boiler (µg/m³)	Total Background Concentration and Biomass Boiler (µg/m³)	Incremental Impact of Biomass Boiler (µg/m³)	Magnitude of Change	Impact Description
Grid Max		14.17	0.22	14.39	0.55	Imperceptible	Negligible
Window 1 SE	2.3	14.17	0.21	14.38	0.52	Imperceptible	Negligible
Window 1 SE	6.35	14.17	0.18	14.35	0.44	Imperceptible	Negligible
Window 1 SE	10.02	14.17	0.15	14.32	0.37	Imperceptible	Negligible

Location	Design Speed (m/s)	Window 1 Altimeter Reading Corrected to Sea Level (m/s)	Window 2 Altimeter Reading Corrected to Sea Level (m/s)	Total Altimeter Reading Corrected to Sea Level (m/s)	Maximum of Altimeter Readings (m/s)	Maximum Wind Speed (m/s)	Final Assessment
Window 1 SE	13.7	14.17	0.12	14.29	0.31	Imperceptible	Negligible
Window 2 SE	2.3	14.17	0.18	14.35	0.45	Imperceptible	Negligible
Window 2 SE	6.35	14.17	0.15	14.32	0.38	Imperceptible	Negligible
Window 2 SE	10.02	14.17	0.13	14.30	0.31	Imperceptible	Negligible
Window 2 SE	13.7	14.17	0.11	14.28	0.27	Imperceptible	Negligible
Window 3 SE	2.3	14.17	0.14	14.31	0.34	Imperceptible	Negligible
Window 3 SE	6.35	14.17	0.12	14.29	0.29	Imperceptible	Negligible
Window 3 SE	10.02	14.17	0.10	14.27	0.24	Imperceptible	Negligible
Window 3 SE	13.7	14.17	0.08	14.25	0.21	Imperceptible	Negligible
Window 4 SE	2.3	14.17	0.10	14.27	0.26	Imperceptible	Negligible
Window 4 SE	6.35	14.17	0.09	14.26	0.22	Imperceptible	Negligible
Window 4 SE	10.02	14.17	0.07	14.24	0.18	Imperceptible	Negligible
Window 4 SE	13.7	14.17	0.06	14.23	0.15	Imperceptible	Negligible
Window 5 SE	2.3	14.17	0.09	14.26	0.23	Imperceptible	Negligible
Window 5 SE	6.35	14.17	0.08	14.25	0.19	Imperceptible	Negligible
Window 5 SE	10.02	14.17	0.06	14.23	0.16	Imperceptible	Negligible
Window 5 SE	13.7	14.17	0.06	14.23	0.14	Imperceptible	Negligible
Window 1 E (Directly above EC)	6.35	14.17	0.19	14.36	0.48	Imperceptible	Negligible
Window 1 E (Directly above EC)	10.02	14.17	0.16	14.33	0.40	Imperceptible	Negligible
Window 1 E (Directly above EC)	13.7	14.17	0.13	14.30	0.34	Imperceptible	Negligible
Window 2 E (Directly above EC)	6.35	14.17	0.19	14.36	0.47	Imperceptible	Negligible
Window 2 E (Directly above EC)	10.02	14.17	0.15	14.32	0.38	Imperceptible	Negligible
Window 2 E (Directly above EC)	13.7	14.17	0.13	14.30	0.33	Imperceptible	Negligible
Corner East Building	2.3	14.17	0.19	14.36	0.49	Imperceptible	Negligible
Corner East Building	6.35	14.17	0.17	14.34	0.41	Imperceptible	Negligible
Corner East Building	10.02	14.17	0.14	14.31	0.34	Imperceptible	Negligible

Location	Speed Limit (mph)	Maximum Benefit Concentration (µg/m ³)	Maximum Benefit Concentration (µg/m ³)	Total Predicted Concentration (µg/m ³)	Excess Over Background Concentration (µg/m ³)	Perceived Effect	Impact Assessment
Corner East Building	13.7	14.17	0.12	14.29	0.29	Imperceptible	Negligible
Main Entrance 1	2.3	14.17	0.18	14.35	0.44	Imperceptible	Negligible
Main Entrance 1	6.35	14.17	0.15	14.32	0.37	Imperceptible	Negligible
Main Entrance 1	10.02	14.17	0.12	14.29	0.31	Imperceptible	Negligible
Main Entrance 1	13.7	14.17	0.10	14.27	0.26	Imperceptible	Negligible
Main Entrance 2	2.3	14.17	0.14	14.31	0.36	Imperceptible	Negligible
Main Entrance 2	6.35	14.17	0.12	14.29	0.30	Imperceptible	Negligible
Main Entrance 2	10.02	14.17	0.10	14.27	0.25	Imperceptible	Negligible
Main Entrance 2	13.7	14.17	0.09	14.26	0.21	Imperceptible	Negligible
Window 1 W	2.3	14.17	0.16	14.33	0.40	Imperceptible	Negligible
Window 1 W	6.35	14.17	0.14	14.31	0.34	Imperceptible	Negligible
Window 1 W	10.02	14.17	0.11	14.28	0.28	Imperceptible	Negligible
Window 1 W	13.7	14.17	0.10	14.27	0.24	Imperceptible	Negligible
Window 2 W	2.3	14.17	0.16	14.33	0.39	Imperceptible	Negligible
Window 2 W	6.35	14.17	0.13	14.30	0.33	Imperceptible	Negligible
Window 2 W	10.02	14.17	0.11	14.28	0.27	Imperceptible	Negligible
Window 2 W	13.7	14.17	0.09	14.26	0.23	Imperceptible	Negligible
Window 3 West	2.3	14.17	0.10	14.27	0.24	Imperceptible	Negligible
Window 3 West	6.35	14.17	0.08	14.25	0.20	Imperceptible	Negligible
Window 3 West	10.02	14.17	0.07	14.24	0.17	Imperceptible	Negligible
Window 3 West	13.7	14.17	0.06	14.23	0.14	Imperceptible	Negligible
30 Frith Road	0	14.17	0.10	14.27	0.24	Imperceptible	Negligible
30 Frith Road	2.5	14.17	0.09	14.26	0.22	Imperceptible	Negligible

Table 23 Maximum and 90.4th Percentile 24 Hour PM10 Concentrations Resulting from the Biomass Boiler on Site (Full Load)

Location	Wind speed (m/s)	Background PM10 Concentration (µg/m³)	Incremental PM10 Concentration (µg/m³)	Incremental PM10 Concentration (µg/m³)	Incremental PM10 Concentration (µg/m³)	Incremental PM10 Concentration (µg/m³)	Incremental PM10 Concentration (µg/m³)	90.4th Percentile PM10 Concentration (µg/m³)
Grid Max	0	28.34		28.34	0.00	Medium	Negligible	4.73
Window 1 SE	2.3	28.34	1.32	29.66	2.63	Small	Negligible	2.11
Window 1 SE	6.35	28.34	1.14	29.48	2.27	Small	Negligible	1.87
Window 1 SE	10.02	28.34	0.94	29.28	1.89	Small	Negligible	1.59
Window 1 SE	13.7	28.34	0.82	29.16	1.63	Small	Negligible	1.36
Window 2 SE	2.3	28.34	1.21	29.55	2.41	Small	Negligible	2.15
Window 2 SE	6.35	28.34	1.03	29.37	2.06	Small	Negligible	1.91
Window 2 SE	10.02	28.34	0.84	29.18	1.69	Small	Negligible	1.62
Window 2 SE	13.7	28.34	0.74	29.08	1.48	Small	Negligible	1.39
Window 3 SE	2.3	28.34	1.01	29.35	2.03	Small	Negligible	1.93
Window 3 SE	6.35	28.34	0.85	29.19	1.71	Small	Negligible	1.71
Window 3 SE	10.02	28.34	0.72	29.06	1.44	Small	Negligible	1.46
Window 3 SE	13.7	28.34	0.61	28.95	1.22	Small	Negligible	1.25
Window 4 SE	2.3	28.34	0.88	29.22	1.77	Small	Negligible	1.64
Window 4 SE	6.35	28.34	0.74	29.08	1.48	Small	Negligible	1.45
Window 4 SE	10.02	28.34	0.61	28.95	1.22	Small	Negligible	1.24
Window 4 SE	13.7	28.34	0.52	28.86	1.05	Small	Negligible	1.06
Window 5 SE	2.3	28.34	0.88	29.22	1.77	Small	Negligible	1.49
Window 5 SE	6.35	28.34	0.75	29.09	1.50	Small	Negligible	1.35
Window 5 SE	10.02	28.34	0.62	28.96	1.24	Small	Negligible	1.21
Window 5 SE	13.7	28.34	0.54	28.88	1.09	Small	Negligible	1.10

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Location	Height (m)	Window Height (m)	Window Area (m²)	Window Volume (m³)	Window Area (m²)	Window Volume (m³)	Window Area (m²)	Window Volume (m³)
Window 1 E (Directly above EC)	6.35	28.34	1.21	29.55	2.42	Small	Negligible	1.85
Window 1 E (Directly above EC)	10.02	28.34	1.03	29.37	2.06	Small	Negligible	1.66
Window 1 E (Directly above EC)	13.7	28.34	0.90	29.24	1.79	Small	Negligible	1.64
Window 2 E (Directly above EC)	6.35	28.34	1.21	29.55	2.42	Small	Negligible	1.84
Window 2 E (Directly above EC)	10.02	28.34	1.04	29.38	2.08	Small	Negligible	1.58
Window 2 E (Directly above EC)	13.7	28.34	0.89	29.23	1.77	Small	Negligible	1.52
Corner East Building	2.3	28.34	1.30	29.64	2.61	Small	Negligible	1.99
Corner East Building	6.35	28.34	1.11	29.45	2.23	Small	Negligible	1.73
Corner East Building	10.02	28.34	0.93	29.27	1.87	Small	Negligible	1.47
Corner East Building	13.7	28.34	0.80	29.14	1.61	Small	Negligible	1.28
Main Entrance 1	2.3	28.34	1.21	29.55	2.42	Small	Negligible	1.99
Main Entrance 1	6.35	28.34	1.03	29.37	2.06	Small	Negligible	1.72
Main Entrance 1	10.02	28.34	0.87	29.21	1.74	Small	Negligible	1.46
Main Entrance 1	13.7	28.34	0.74	29.08	1.49	Small	Negligible	1.27
Main Entrance 2	2.3	28.34	1.11	29.45	2.21	Small	Negligible	1.89
Main Entrance 2	6.35	28.34	0.97	29.31	1.93	Small	Negligible	1.64
Main Entrance 2	10.02	28.34	0.80	29.14	1.59	Small	Negligible	1.37
Main Entrance 2	13.7	28.34	0.68	29.02	1.35	Small	Negligible	1.16
Window 1 W	2.3	28.34	1.44	29.78	2.88	Small	Negligible	2.85
Window 1 W	6.35	28.34	1.21	29.55	2.43	Small	Negligible	2.44
Window 1 W	10.02	28.34	0.99	29.33	1.98	Small	Negligible	2.04

Location	Height (m)	Without Biomass Boiler Contribution (µg/m³)	Incremental Biomass Boiler Contribution (µg/m³)	Total Background Concentration with Biomass Boiler (µg/m³)	Incremental % of Objective (µg)	Magnitude of Change	Impact Descriptor	Max 24h Concentration (µg/m³)
Window 1 W	13.7	28.34	0.86	29.20	1.72	Small	Negligible	1.77
Window 2 W	2.3	28.34	1.37	29.71	2.74	Small	Negligible	2.59
Window 2 W	6.35	28.34	1.19	29.53	2.37	Small	Negligible	2.31
Window 2 W	10.02	28.34	0.99	29.33	1.97	Small	Negligible	1.97
Window 2 W	13.7	28.34	0.84	29.18	1.69	Small	Negligible	1.68
Window 3 West	2.3	28.34	1.11	29.45	2.22	Small	Negligible	2.56
Window 3 West	6.35	28.34	0.94	29.28	1.88	Small	Negligible	2.15
Window 3 West	10.02	28.34	0.79	29.13	1.59	Small	Negligible	1.80
Window 3 West	13.7	28.34	0.67	29.01	1.35	Small	Negligible	1.53
30 Frith Road	0	28.34	0.87	29.21	1.73	Small	Negligible	1.64
30 Frith Road	2.5	28.34	0.85	29.19	1.70	Small	Negligible	1.62

Table 24 Maximum and 90.4th Percentile 24 Hour PM10 Concentrations Resulting from the Biomass Boiler on Site (Low Load)

Location	Height (m)	Without Biomass Boiler Contribution (µg/m³)	Incremental Biomass Boiler Contribution (µg/m³)	Total Background Concentration with Biomass Boiler (µg/m³)	Incremental % of Objective (µg)	Magnitude of Change	Impact Descriptor	Max 24h Concentration (µg/m³)
Grid Max	0	28.34	0.42	28.76	0.84	Imperceptible	Negligible	0.73
Window 1 SE	2.3	28.34	0.31	28.65	0.63	Imperceptible	Negligible	0.61
Window 1 SE	6.35	28.34	0.27	28.61	0.54	Imperceptible	Negligible	0.54
Window 1 SE	10.02	28.34	0.22	28.56	0.44	Imperceptible	Negligible	0.46
Window 1 SE	13.7	28.34	0.19	28.53	0.38	Imperceptible	Negligible	0.40
Window 2 SE	2.3	28.34	0.27	28.61	0.53	Imperceptible	Negligible	0.52
Window 2 SE	6.35	28.34	0.23	28.57	0.46	Imperceptible	Negligible	0.46
Window 2 SE	10.02	28.34	0.19	28.53	0.38	Imperceptible	Negligible	0.39

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Location	Height (m)	Window 1 Annual Mean Concentration (µg/m³)	Window 2 Annual Mean Concentration (µg/m³)	Window 3 Annual Mean Concentration (µg/m³)	Window 4 Annual Mean Concentration (µg/m³)	Window 5 Annual Mean Concentration (µg/m³)	Corner East Building Annual Mean Concentration (µg/m³)
Window 2 SE	13.7	28.34	0.16	28.50	0.32	Imperceptible	Negligible 0.34
Window 3 SE	2.3	28.34	0.22	28.56	0.45	Imperceptible	Negligible 0.41
Window 3 SE	6.35	28.34	0.19	28.53	0.38	Imperceptible	Negligible 0.36
Window 3 SE	10.02	28.34	0.15	28.49	0.31	Imperceptible	Negligible 0.31
Window 3 SE	13.7	28.34	0.13	28.47	0.27	Imperceptible	Negligible 0.27
Window 4 SE	2.3	28.34	0.19	28.53	0.38	Imperceptible	Negligible 0.33
Window 4 SE	6.35	28.34	0.16	28.50	0.32	Imperceptible	Negligible 0.29
Window 4 SE	10.02	28.34	0.13	28.47	0.26	Imperceptible	Negligible 0.24
Window 4 SE	13.7	28.34	0.11	28.45	0.23	Imperceptible	Negligible 0.21
Window 5 SE	2.3	28.34	0.19	28.53	0.38	Imperceptible	Negligible 0.37
Window 5 SE	6.35	28.34	0.16	28.50	0.32	Imperceptible	Negligible 0.33
Window 5 SE	10.02	28.34	0.13	28.47	0.27	Imperceptible	Negligible 0.31
Window 5 SE	13.7	28.34	0.12	28.46	0.23	Imperceptible	Negligible 0.30
Window 1 E (Directly above EC)	6.35	28.34	0.30	28.64	0.61	Imperceptible	Negligible 0.59
Window 1 E (Directly above EC)	10.02	28.34	0.25	28.59	0.50	Small	Negligible 0.51
Window 1 E (Directly above EC)	13.7	28.34	0.21	28.55	0.43	Imperceptible	Negligible 0.44
Window 2 E (Directly above EC)	6.35	28.34	0.29	28.63	0.58	Imperceptible	Negligible 0.58
Window 2 E (Directly above EC)	10.02	28.34	0.24	28.58	0.48	Imperceptible	Negligible 0.50
Window 2 E (Directly above EC)	13.7	28.34	0.20	28.54	0.41	Imperceptible	Negligible 0.43
Corner East Building	2.3	28.34	0.30	28.64	0.60	Imperceptible	Negligible 0.61

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Location	Height (m)	Winter Heating Contribution (µg/m ³)	Summer Heating Contribution (µg/m ³)	Other Heating Contribution (µg/m ³)	Maximum Concentration Exposure Index (µg/m ³)	Assessment Category	Impact Category	Concentration Exposure Index (µg/m ³)
Corner East Building	6.35	28.34	0.26	28.60	0.52	Small	Negligible	0.53
Corner East Building	10.02	28.34	0.22	28.56	0.43	Imperceptible	Negligible	0.45
Corner East Building	13.7	28.34	0.18	28.52	0.37	Imperceptible	Negligible	0.39
Main Entrance 1	2.3	28.34	0.27	28.61	0.54	Imperceptible	Negligible	0.61
Main Entrance 1	6.35	28.34	0.24	28.58	0.47	Imperceptible	Negligible	0.53
Main Entrance 1	10.02	28.34	0.20	28.54	0.39	Imperceptible	Negligible	0.45
Main Entrance 1	13.7	28.34	0.17	28.51	0.33	Imperceptible	Negligible	0.38
Main Entrance 2	2.3	28.34	0.23	28.57	0.46	Imperceptible	Negligible	0.51
Main Entrance 2	6.35	28.34	0.20	28.54	0.39	Imperceptible	Negligible	0.44
Main Entrance 2	10.02	28.34	0.16	28.50	0.33	Imperceptible	Negligible	0.36
Main Entrance 2	13.7	28.34	0.14	28.48	0.28	Imperceptible	Negligible	0.31
Window 1 W	2.3	28.34	0.25	28.59	0.51	Imperceptible	Negligible	0.45
Window 1 W	6.35	28.34	0.22	28.56	0.44	Imperceptible	Negligible	0.38
Window 1 W	10.02	28.34	0.18	28.52	0.37	Imperceptible	Negligible	0.32
Window 1 W	13.7	28.34	0.16	28.50	0.32	Imperceptible	Negligible	0.28
Window 2 W	2.3	28.34	0.26	28.60	0.51	Imperceptible	Negligible	0.46
Window 2 W	6.35	28.34	0.21	28.55	0.43	Imperceptible	Negligible	0.40
Window 2 W	10.02	28.34	0.18	28.52	0.35	Imperceptible	Negligible	0.34
Window 2 W	13.7	28.34	0.15	28.49	0.30	Imperceptible	Negligible	0.29
Window 3 West	2.3	28.34	0.21	28.55	0.42	Imperceptible	Negligible	0.43
Window 3 West	6.35	28.34	0.18	28.52	0.36	Imperceptible	Negligible	0.38
Window 3 West	10.02	28.34	0.14	28.48	0.29	Imperceptible	Negligible	0.32

Location	Height (m)	Without Boiler Contribution ($\mu\text{g}/\text{m}^3$)	Imputed Boiler Contribution ($\mu\text{g}/\text{m}^3$)	Total Background Concentration and Boilers Boiler ($\mu\text{g}/\text{m}^3$)	Exposure at 1m to Obstacle (μg)	Significance of Change	Imputed Boiler Contribution	Exposure at 1m to Obstacle (μg)
Window 3 West	13.7	28.34	0.12	28.46	0.25	Imperceptible	Negligible	0.27
30 Frith Road	0	28.34	0.21	28.55	0.41	Imperceptible	Negligible	0.41
30 Frith Road	2.5	28.34	0.20	28.54	0.40	Imperceptible	Negligible	0.40